



British Guiana.

DIVISIONAL REPORTS

OF THE

DEPARTMENT OF AGRICULTURE,

FOR THE YEAR

1933.

GEORGETOWN, DEMERARA:

PRINTERS TO THE GOVERNMENT OF BRITISH GUIANA.

"THE ARGOSY" COMPANY, LIMITED.

1934.

DEPARTMENT OF AGRICULTURE.

HEAD OFFICE.

Director of Agriculture	...	...	Prof. the Hon. J. Sydney Dash, B.S.A. (McGill).
Deputy Director of Agriculture	...	...	F. Burnett, M.C., M.A. (Oxon.).

DISTRICT AGRICULTURAL SUPERINTENDENTS.

East Demerara	...	...	E. M. Peterkin.
North West District	...	...	E. Beckett, F.L.S.
Essequibo	...	...	A. de K. Frampton, C.D.A.
West Demerara	...	...	J. D. Gillespie, B.Sc. (Edin.).
Berbice	...	...	H. Macluskie, U.D.A. (Aberdeen).
Essequibo (Assistant Agricultural Superintendent)	...	...	A. A. Abraham.
Demerara (Assistant Agricultural Superintendent)	...	...	H. D. Huggins, M.Sc. (Cornell), Dip. Agri. (I.C.T.A.)

RESEARCH—(LABORATORIES).

Entomologist (Seconded, Moth Borer Investigations)	...	...	L. D. Cleare, F.L.S., F.E.S.
Supernumerary Entomologist	...	...	F. A. Squire, B.Sc. (S.A.).
Botanist and Mycologist	...	...	E. B. Martyn, B.A. (Oxon. et Cantab.).
Chemist-Ecologist...	...	...	R. R. Follett-Smith, B.Sc. (Lond.) A.R.C.S.
Assistant Chemist...	...	...	C. L. C. Bourne.

RESEARCH—(FIELD EXPERIMENT STATIONS).

Livestock Farm, Georgetown—(Veterinary Surgeon)	...	...	T. Bone, O.B.E., M.R.C.V.S.
Experiment Station (Sugar), Sophia— (Cane Agronomist)	...	...	C. H. B. Williams, M.A. (Harvard), A.I.C.T.A., Dip. Agr.
Experiment Station (Rice), Georgetown— (Plant Breeder)	...	...	L. E. W. Codd, M.Sc. (S.A.).
Experiment Station, Cecilia, E.C., Demerara	...	...	E. M. Peterkin.
Experiment Station, Hosororo, N.W.D.	...	...	E. Beckett, F.L.S.
Experiment Station, Whim, Corentyne, Berbice	...	...	H. Macluskie, U.D.A. (Aberdeen).
Experiment Station, Henrietta, Essequibo	...	...	} A. de K. Frampton, C.D.A.
Bush Lot Land Settlement Scheme	...	...	
Demonstration and Queen-Breeding Apiary, Botanic Gardens	...	...	H. D. Huggins, M.Sc. (Cornell), Dip. Agri. (I.C.T.A.)

BOTANIC GARDENS.

Superintendent in Charge	...	...	E. B. Martyn, B.A. (Oxon. et Cantab.).
Horticultural Assistant	...	...	H. A. Cole.

AGRICULTURAL INSTRUCTORS.

Resident Instructor, Berbice	...	...	E. M. Morgan.
Resident Instructor, East Demerara	...	...	C. C. Dowding, F.L.S., F.R.H.S.
Resident Instructor, West Demerara	...	...	D. D. Haynes,
Resident Instructor, Essequibo Islands	...	...	A. W. Sears.

AGRICULTURAL ASSISTANTS.

Experiment Station, Georgetown	...	...	J. Indrobeharry.
Experiment Station, Berbice	...	...	H. B. France.

LABORATORY ASSISTANTS.

Meteorological Observer	...	...	D. D. Blackman.
Entomological Assistant	...	...	C. Williams.
Botanical and Mycological Assistant	...	...	N. Persaud.

RICE GRADING STAFF.

Grading Inspector	...	...	E. G. A. Benson, B.Sc. (Lond.), Dip. Agr. (Wye). A.I.C.T.A.
-------------------	-----	-----	--

Senior Examiner, Georgetown	...	...	W. A. Bovell.
Senior Examiner, Springlands	...	...	R. R. Ross.

CLERICAL STAFF.

Senior Clerk, Head Office	...	...	J. F. Irving, M.C.
Registrar (Co-operative Banks)	...	...	W. G. Delph.
Accountant	...	...	A. A. Thorne, Jnr.
6th Class Clerk	...	...	Miss O. Bardon.
Clerical Assistants	...	...	Miss D. M. Terrill, Miss M. Cheong, Miss V. Chan-Choong.
Clerk, Botanic Gardens	...	...	G. L. Leitch.

SUGAR EXPERIMENT STATIONS.

Agronomist	...	...	C. H. B. Williams, M.A. (Harvard), A.I.C.T.A., Dip. Agr.
Field Manager	...	...	C. Cameron.
Laboratory Assistant	...	...	L. A. Robinson.
Field Assistant	...	...	L. A. Forte (seconded).
Field Assistant	...	...	B. A. McArthur.
Clerical Assistant	...	...	J. B. Bourne.

In collaboration with the Officers of the Department of Agriculture.

C.S.O. No 1720/34.



British Guiana.

DIVISIONAL REPORTS

OF THE

DEPARTMENT OF AGRICULTURE,

FOR THE YEAR

1933.

Printed by the Authority of His Excellency the Governor.

GEORGETOWN, DEMERARA :

" THE ARGOSY " COMPANY, LIMITED, PRINTERS TO THE GOVERNMENT OF BRITISH GUIANA.

1934.

No. 16,274

TABLE OF CONTENTS.

			PAGE.
Report of the Berbice Division	...	...	5
Report of the East Demerara Division	...	...	17
Report of the West Demerara Division	...	...	31
Report of the Essequibo Division	...	...	39
Report of the North West Division	...	...	53
Report of the Plant Breeder	...	...	61
Report on the Sugar Experiment Stations	...	...	73
Report of the Chemical Division	...	...	83
Report of the Botanical and Mycological Division	...	...	105
Report on the Botanic Gardens	...	...	115
Report of the Entomological Division	...	...	125
Report of the Veterinary Division	...	...	131

NOTE.—Each report also contains its table of contents.

https://archive.org/details/annual-report-agriculture-british-guiana_1933

DEPARTMENT OF AGRICULTURE.

REPORT OF THE BERBICE DIVISION FOR THE YEAR 1933.

CONTENTS.

	PAGE.
GENERAL	5
CROP CONDITIONS	5
Sugar ; Rice ; Coconuts ; Ground Provisions ; Vegetables and Fruit.	
SUGAR	6
RICE	7
Grading.	
WHIM SUB-STATION	8
General ; Tomatoes ; Cabbage ; Onions ; Miscellaneous Crops—Mesquite ; Chinese Yams ; Pawpaws ; Sweet Potatoes ; Legumes ; Fodder Crops.	
PLANT AND SEED DISTRIBUTION	9
MACAW SUB-STATION	10
General.	
AGRICULTURAL EDUCATION AND EXTENSION	10
Competitions, (Rice, Miscellaneous Farms and Onions) ; Ground Pro- visions ; Citrus ; School Gardens.	
COLONY HOUSE GARDENS AND PRISON FARM	13
CO-OPERATIVE CREDIT BANKS	14
MISCELLANEOUS	14
Reports ; Acknowledgments.	

REPORT OF THE BERBICE DIVISION FOR THE YEAR 1933.

STAFF.

Hector Macluskie, U.D.A. (Aberdeen)	—Agricultural Superintendent.
E. M. Morgan	—Agricultural Instructor, Corentyne.
H. B. France	—Agricultural Assistant, New Amsterdam.
R. R. Ross	—Rice Grading Examiner, Springlands.

An addition to the staff was made in January by the appointment of Mr. Ross as Rice Grading Examiner for the port of Springlands.

2. For efficiency in district work generally, adequate travelling facilities are required for all officers. The Agricultural Assistant has no travelling allowance and therefore his activities are limited to a narrow radius and, in a large district such as this, full use cannot be made of his services.

GENERAL.

3. The year under review was one of considerable progress in the Division. Sugar estates have continued their marked interest in seedling canes and it is interesting to note that P.O.J. 2878 and Diamond 10 are the most widely favoured in the district, with D. 663/13, D. 814/12 and S.C. 12/4 next in order. Seven new experiments were laid down, namely, four manurial trials, two variety trials and one flood-fallowing trial. Rice examination for export continued and increased activity was experienced at Springlands where the erection of a storage bond and a Rice Grading Office have materially assisted shipping.

Two stations were opened during the year; Whim Sub-station as a seed distribution centre and Macaw Sub-station for a demonstration area primarily with oil palms and legumes. Each station has been of considerable benefit to farmers in the district. At the padi barns in Whim and New Amsterdam, pure line padi was stored and distributed to rice farmers who now fully realise the benefits derived from planting pure line seed padi. Two school gardens were started during the year one at Auchlyne School and the other at Edinburgh Scots School.

General extension work in the villages has been carried out by all officers and assistance rendered to farmers where necessary. Three agricultural competitions for farmers were organised in villages during the year. Credit facilities were supervised through the Co-Operative Credit Banks and the agricultural census returns were collated.

Full details of work done will be found under their respective heads.

CROP CONDITIONS.

4. Weather conditions during the first nine months of the year were satisfactory generally, but the early arrival of the rains in the latter part of October proved embarrassing to agriculturists and in many areas caused considerable losses. In the month of October when rice harvesting was well started the coastlands had a flooded appearance. During the last three months of the year 46.76 inches of rain were recorded in New Amsterdam.

Sugar.

5. The total acreage under cultivation was 22,573 English acres whilst the total acreage reaped including farmers' canes, was 21,241 English acres yielding 60,540 of which 59,661 tons were produced on Sugar estates. The total yield was 3,060 tons less than that of the previous year. This fall in yield from an increased acreage was due to poor juice over a long period and also to the fact that certain areas of cane due to be reaped in the autumn crop had to be thrown over to 1934 owing to the extremely wet weather which prevailed at the end of the year.

Further losses will be reflected in 1934 in the case of fields cut during wet weather which as a result did not spring well.

Rice.

6. The rice crop gave indications of being a record one, but the early arrival of the rains, put a new complexion on the crop and heavy losses in the field were sustained in many districts. The harvest, which in any one area generally is completed in 2 weeks, was spread over several weeks, with added handling in order to dry out the crop for threshing. Those areas which were not affected to any great extent were the Upper Corentyne and the Upper West Coast, Berbice. It is estimated that the total losses of rice throughout the whole of the Districts amounted to about 30% of the crop. During December the rains brought milling operations to a standstill, and the price of rice rose in consequence.

Coconuts.

7. The position of this industry remains unchanged. Nearly all the nuts are made into oil and sold locally. In some areas, interest has turned towards the shipping of selected nuts to Georgetown for export. There is little copra made in the district.

Ground Provisions, Vegetables and Fruit.

8. There has been a gradual increase in the areas under ground provisions and vegetables, and farmers are showing more interest especially in the growing of sweet potatoes and yams.

9. Marked interest has been shown this year in the cultivation of fruit plants and farmers are strongly advised to continue increasing such areas to meet the local demand. At present fruit is brought to the New Amsterdam market from as far distant as the Pomeroon District. The sand reefs on the Corentyne are suitable areas provided that shelter from the high winds is provided.

SUGAR.

10. The following work in connection with sugar cane trials was carried out in collaboration with the Staff of the Sugar Experimental Station, Sophia:—

In February, a variety trial with 1921 seedlings was planted at Port Mourant in field Ankerville Empolder East No. 28 and soil samples were submitted to the Chemical Division. A manurial trial (1st ratoons) on the same estate was reaped in field Ankerville No. 6.

In March, at Rosehall, a manurial trial with graded doses of sulphate of ammonia was laid down in field Rosehall No. 30, and soil samples taken.

In April, field Ankerville No. 28 Port Mourant was supplied and field Ankerville No. 14 (variety trial-plants) was sampled and reaped.

In May, a variety trial with 1928 seedlings was planted at Port Mourant in field Ankerville No. 15.

In June, a flood-fallowing experiment in field Tain No. 28 Windward, Port Mourant, was soil sampled. This field was also visited for observation of growth of nut grass on the various treatments.

In July, field Ankerville No. 15, Port Mourant was supplied and soil sampled, and further observations on the growth of nut grass in field Tain No. 28 Windward, were made.

In September, at Blairmont ten soil samples were obtained for the Chemical Division in connection with the determination of a phosphate-deficient field for phosphate experimentation.

In October, at Port Mourant fields Resource No. 6 (variety trial 2nd ratoon) and Ankerville No. 8 (variety trial 1st ratoon) were sampled and reaped. At Blair-

mont field Riverside No. 11 (variety trial 2nd ratoon) was sampled, and field Riverside No. 18 (variety trial 1st ratoon) was sampled and reaped. Soil samples were obtained at Rosehall in field No. 19, Lot 20, to be tested for phosphate deficiency and for phosphate experimentation.

In November, field No. 11 Riverside at Blairmont was reaped, and on the same estate a phosphate trial was laid down in field Haly Polder No. 15. At Blairmont also a variety trial (plants) was reaped in field Haly Polder No. 4. A phosphate trial was laid down at Rosehall in field No. 19, Lot 20, and soil samples of the actual area were also taken.

In December, in field Ankerville No. 1, Port Maurant, three small areas of half a square rod each were marked off and samples of the top soil taken. Limestone was then applied to the areas at the rate of 1 ton per acre and the field subsequently submerged for flood-fallowing. When the water is later run off, soil samples will be obtained from the identical areas, with a view to studying the effects of liming before flooding. At Port Maurant soil samples were also taken in field Resource No. 13 with a view to determining its suitability for a phosphate trial.

RICE.

11. Rice work has been chiefly confined to the propagation and distribution of pure line seed padi. This has been achieved through the medium of—(1) Propagation blocks, (2) Competitions, (3) Loans to padi farmers and by sales. A block of fifteen acres (12 acres Demerara Creole and 3 acres No. 79) was established at Hogstye, Corentyne. The crop promised to be a very heavy one and reaping commenced in October. Excessive rainfall, however, ruined a large proportion of the crop with the result that only 76 bags of winnowed seed were stored. The crop was estimated at 300 bags of 140 lbs. Two padi competitions, to which further reference is made in paragraphs 34-43, were held. Due to the heavy rains which prevailed during the harvesting period, considerable quantities of pure line seed grown in the competition plots were destroyed. Similarly, with persons obtaining padi under the pure line loan scheme, heavy losses were experienced. In view of the severe damage done to the 15-acre block at Hogstye, 51 bags of seed were purchased from the competition blocks.

12. The following table shows the quantities of seed padi distributed during the year :—

Loaned to farmers	...	...	104 bags
Sales to farmers	...	...	16 "
Competition plots	...	...	9 "
Sales through rice millers (Revolving Fund padi) ...			207 "
Total	...		<u>336 bags*</u>

Rice Grading.

13. The following tables show fully the quantities and grades of rice examined prior to export :—

NEW AMSTERDAM.

Destination.	No. 1.	No. 2.	No. 3.	Broken.	Total.
Barbados	...	3,365	125	...	3,490
Grenada	...	...	200	...	200
St. Kitts	...	70	410	...	480
Trinidad	400	1,100	580	100†	2,180
Jamaica	...	1,721	1,490	...	3,121
New York	100	...	...	...	100
	500	6,256	2,715	100	9,571

SPRINGLANDS.

Barbados	...	...	...	600	600
Martinique	...	500	4,500	1,000†	6,000
Guadeloupe	...	5,050	11,900	250†	17,200
	...	5,550	17,000	1,250	23,800

*One bag=140 lbs.

†Indicates not shipped.

14. During the year several visits to the port of New Amsterdam (Providence Estate wharf) were made by the Trinidad Government ship s.s. "Trinidad." It is unfortunate that rice exporters were not in a position to make fuller use of this opportunity for direct shipment to Trinidad only 400 bags being shipped.

WHIM SUB-STATION.

General.

15. Towards the end of 1932 about three-quarters of an acre of sand-reef land, adjoining the padi barn, was fenced, a water supply provided and a nursery established. During 1933 the area was sub-divided into beds, drains were dug and paths made. The Agricultural Instructor, Corentyne, is in charge of this Sub-station.

16. The object of the Station is primarily to supply seed to the farmers of the district. At the same time demonstrations and observation plots of economic crops are arranged. The Corentyne coast has for some time been a tomato-growing area. The type of tomato grown is from the Creole varieties. The fruits are small and sour as a result of the constant resowing of generation after generation of home-grown seed. Consideration has been given therefore to this crop and observation plots of tomatoes from imported seed were established. At the same time large numbers of seedlings grown from such seed were distributed to farmers when available.

17. Edible legumes also received attention and small plots from seed received from Cecilia Sub-station were established for propagation. Seed was distributed free to farmers. Other demonstrations included plots of cabbages, onions, sweet potatoes and tobacco, crops in which some interest is now being taken on the Coast. The station was visited during the year by His Excellency the Governor whilst the Deputy Director of Agriculture inspected the station on several occasions. A large number of farmers from the Corentyne District also visited and were shown around the plots.

Tomatoes.

18. Early in April the following varieties were established in observation plots.—Early Market, Marglobe, John Baer, Bonny Best (Canada) and Bonny Best (U.S.A.) In the early stages the plots suffered from dry weather but heavy rains coincided with fruiting which commenced in May. The rains continued until the end of the crop. Blossom End Rot was prevalent and in order to ascertain which variety suffered least from the disease, records of affected fruit were kept and these are tabulated below.

Variety.	Size of Plot, sq. ft.	Yield of rotten fruit, lbs.	Yield per 1,000 sq. ft. rotten fruit.	Percentage total rotten fruit.
Early Market	1,075	59.5	54.8	8.5
Marglobe	528	57.75	107	16.0
John Baer	528	59.75	113	17.0
Bonny Best (United States of America) ...	528	63.75	110	15.5
Bonny Best (Canada)	224	62.25	278	42
	2,883	303 lbs.	662	100.0

19. From the above table it will be readily seen that Early Market was least affected by "rot" and the Bonny Best Canada variety was the most affected.

20. Before the crop was thrown out, cuttings were taken from each variety and planted in plots for extension purposes. In September a randomised experiment of 20 plots was planted with the rooted cuttings, with the object of studying the effect of cuttings on the resulting fruits. This trial has been affected by Mosaic which destroyed some plots of the Bonny Best varieties entirely. Full particulars of this experiment will not be available until the fruiting is finished.

Cabbage.

21. A small plot of Sutton's Earliest Cabbage was planted out as a demonstration in October. The size of the plot was 1,232 sq. feet and the number of plants totalled 122; of these, 91 made heads equivalent to a yield of about 6,000 lbs. per acre.

Onions.

22. In the early part of the year a small plot of the white variety was tried out but owing to the late arrival of the seed germination was not good. It is interesting to note, however, that 3 lbs. of onions from the plot were kept until December when they were planted out for observation. In November nurseries of onion seed imported by the Department from Teneriffe were sown, and transplanted in December, but the heavy rains proved too much for them and many were killed. Two demonstration plots with the red and white varieties have been established, however, and are growing well.

Miscellaneous Crops.

23. *Mesquite*.—Two varieties of Mesquite seeds were received from the Botanical Division for trial. These were sown and were transplanted as a hedge and on beds, and have made satisfactory progress.

24. *Chinese Yams*.—These have made very poor growth but will be given a further trial.

25. *Paw-Paws*.—Two varieties are being tried—Panama, seed of which was obtained from the Botanical Division and Mammoth Long obtained from Mr. Landells. Both varieties have just been planted out.

26. *Sweet Potatoes*.—Eight varieties of sweet potato were established for distribution purposes, and as will be seen from the distribution records, 32,500 cuttings were distributed to farmers.

27. *Legumes*.—The following varieties of legumes were also established for propagation and distribution purposes:—Urid, mung, lima beans, cow peas, bush bonavist, dwarf bonavist, soya beans, black eye peas, canavalia beans, bengal beans and calapagonium. All of these varieties did very well; the calapagonium proved to be a very shy seeder, but an excellent cover crop.

28. *Fodder Crops*.—Efforts are being made to induce stock breeders to plant up fodder grasses. The farmers are, however, very slow in taking to anything in this line. They prefer to walk several miles for a bunch of para grass than to grow a patch of guatemala in their yards.

PLANT AND SEED DISTRIBUTION.

29. The following is a summary of plants, cuttings and seeds of field crops distributed during the period under review to farmers in the district:—

Urid	...	...	$\frac{1}{2}$ lb.
Mung	...	...	13 $\frac{1}{2}$ lbs.
Lima Beans	...	...	3 $\frac{3}{4}$ lb.
Cow peas	...	...	4 $\frac{1}{2}$ lbs.
Bush bonavist	...	...	3 $\frac{3}{4}$ lbs.
Dwarf bonavist	...	...	3 lbs.
Black eye peas	...	...	2 $\frac{3}{4}$ lbs.
Soya Beans	...	...	$\frac{1}{4}$ lb.
Canavalia beans	...	...	12 $\frac{1}{2}$ lbs.
Tobacco (seed)	...	...	4 ozs.
Tobacco (seedlings)	...	...	252 plants.
Cabbage (seedlings)	...	...	153 plants.
Tomato (seed)	...	...	12 $\frac{1}{2}$ ozs.
Tomato (seedlings)	...	...	1,680 plants.
Tomato (cuttings)	...	...	36 cuttings.
Potato (cuttings)	...	...	32,500 cuttings.

MACAW SUB-STATION.

General.

30. The work of clearing and draining a section on Macaw, East Bank, Berbice River, which was commenced in December, 1932, was completed. As the clearing advanced canavalia beans were planted as a cover crop with success. Holes for the oil palms were prepared and allowed to settle and the palms, which were obtained from the Botanical Gardens from imported seed, were planted out in June.

31. The area of the clearing is just two acres; and 115 palms are planted at a distance of about two rods each. In the second half of the year two weedings were given to the area. In the first weeding the first crop of canavalia beans was reaped. Six bags of beans were distributed to farmers and a further crop planted. At the first sowing the beans were broadcasted unsuccessfully owing to the fact that all the beans were eaten by bush animals. Later the area was given a light weeding and beans were planted in holes with success. Coushi ants were the most serious pests to contend with and constant attention was needed to affect control. By the end of the year the palms had made good growth and none had been lost, although two plants were replaced owing to their weak condition.

32. A façade fence and bridge were erected during the year and the drainage proved to be satisfactory, as despite the very heavy rains during the latter part of the year, coupled with high spring tides, no flooding occurred.

AGRICULTURAL EDUCATION AND EXTENSION.

Competitions.

33. In this District the following agricultural competitions were held during 1933:—

(1) For the best block of transplanted pure line seed padi (autumn crop) on the West Coast (Lichfield Village) and on the Corentyne Coast (Liverpool, Lancaster and Manchester Villages) the area to be not less than half an acre.

1st prize	...	...	\$ 15
2nd prize	...	...	10
3rd prize	...	...	5

(2) For the best miscellaneous farm between Islington and Sisters Villages on the East Bank, the area to be not less than quarter of an acre.

1st prize	...	...	\$ 15
2nd prize	...	...	10
3rd prize	...	...	5

(3) For the best block of onions grown from seed obtained from the Department of Agriculture, on the Corentyne Coast between Nigg to Alness and Saltoun to Maida, the area to be not less than 5 square rods.

1st prize	...	...	\$ 5
2nd prize	...	...	2

34. *Rice Competitions.*—The following were the points upon which the competitions were judged:—

Preparation and seeding of nursery	...	...	25 points.
Cultural operations in the field	...	...	20 "
Uniformity of type	...	...	15 "
Control of insect pests and diseases	...	...	10 "
Yield	...	...	20 "
Hand threshing	...	...	10 "

Reaping had to be done only when the crop was uniformly mature; padi reaped was to be sold as far as possible for seed purposes whilst all competitors who had purchased pure seed from the Department were given a "pure seed certificate"; eighteen such certificates were issued this year.

35. Although the padi competition on the West Coast, Berbice, was held at Bush Lot as in previous years this was not the original intention of the Department. In the first place Lichfield was chosen but through lack of support the site was changed to Seafield, an area well suited for the purpose. Twenty entries were received but when seed distribution was about to take place it was learnt that the entrants did not desire to enter for the competition. Rather than abandon all hopes of a competition amongst the West Coast farmers the Bush Lot area was resorted to, and it is a pleasure to record 24 entries. In the two previous years seed supplies had been distributed to the farmers at Bush Lot with the result that the village has become a pure seed area on a fairly large scale. No further supplies were therefore distributed but the people were informed that they should use their own seed. Padi growing in Bush Lot is of a high order, as cultural operations and other items are usually well attended to.

36. Points were chiefly lost for lack of weeding and failure to eliminate foreign grains of which there were remarkably few. Some farmers had absolutely pure plots whilst others had left a few heads which were sufficient to entitle a deduction in points. Final judging and points awarded showed a close finish with three persons tying for second prize. At Bush Lot there were no losses in padi such as were experienced elsewhere and the quality of the grain reaped was good. It is hoped that those obtaining certificates will use them for the propagation of pure seed elsewhere. The following were the prize winners :—

1st prize	...	(\$15)—Jaimungal.
2nd „	...	(\$ 5 each)—Ramotar Ramdanny ; Cheragdeen and J. Mohabeer.

37. The Corentyne competition was at first strongly supported, 161 entries being received. Of this number only 78 persons availed themselves of the opportunity of obtaining pure line seed. By the rules of the competition each plot had to measure at least half an acre and only twenty-six completed this area. Generally speaking the plots were good but most points were lost in cultural operations. The best cared for plots were seen in Manchester Village which received all the awards. The grain was well developed generally—plump and of good colour and it is unfortunate that weather conditions, which had been favourable throughout, spoilt a considerable portion of the crop. The following were the prize winners :—

1st prize	...	(\$15)—Ivan de Freitas.
2nd „	...	(\$10)—Jardine.
3rd „	...	(\$ 5)—Rose La Rose.

In this competition eight seed certificates were awarded.

38. *Miscellaneous Farms' Competition.*—The competition this year was confined to the area between Islington and Sisters. The points on which it was judged were as follows :—

Drainage	...	...	30 points
General lay-out and state of cultivation	...	...	30 „
Condition of crops, control of pests and diseases	...	...	20 „
Livestock (including poultry)	...	...	20 „

In previous years this competition had been open to farmers residing in the area between New Amsterdam and Mara. This year, however, it was decided to confine the competition to the area between Islington and Sisters in order to encourage farmers to cultivate small holdings. The proximity to market of persons residing in the area is an asset which should be fully exploited by them.

39. Eighteen entries were received. The holdings generally were only in a moderately fair condition, very little or no attention was paid to drainage, there was lack of planning while mixing of crops upon the beds was common. The crops cultivated consisted chiefly of plantains, bananas, eddoes, cassava and to a small

extent sweet potatoes. Legumes were not grown although as an incentive farmers were offered free distribution of peas and beans, while only one competitor grew crops of tomato and cabbage.

40. The winner of the first prize, Mr. Archibald of Edinburgh, was the only entrant who obtained points for livestock. He also paid careful attention to the layout of his plot; the sweet potato and cassava crops were good although more attention was needed in the pineapple section. The winner of the second prize made attempts to segregate his crops and carefully planned his layout.

The prize winners were as follows :—

1st prize	...	... (\$15)—C. Archibald, Edinburgh.
2nd prize	...	... (\$10)—Prescott, Rotterdam.
3rd prize	...	... (\$ 5)—Bacchus, Rotterdam.

41. *Onion Competitions*.—This was run in the Corentyne District, between Nigg to Alness, and Saltoun to Maida. The rules were as follows ;—

The nurseries had to be properly prepared ; seed had to be sown in rows not less than 4 inches apart and seedlings transplanted at five weeks old. The beds had to be prepared to meet the Department's requirements and the cultivations kept free from weeds while it was imperative that the Agricultural Officer be notified of the date of reaping.

42. Weather conditions were not altogether favourable during the period of both nursery and development stages which affected the yields to a great extent. In spite of this, some fine nurseries and cultivations were in evidence. Twelve entries were received for the Nigg to Alness Block and eleven for the Saltoun to Maida area. All the plots entered, with the exception of two, were in excess of five square rods, the largest was seen at Letter Kenny where the area was approximately one-quarter of an acre which yielded 996 lbs. The beds were kept reasonably clean throughout the period of growth, were fairly well manured and maintained a fine tilth. The bulbs were of medium size and when dried weighed on an average 15 lbs. per 100 bulbs.

The prize-winners were as follows :—

NIGG TO ALNESS.

1st prize	...	... (\$5)—Jagroop, Letter Kenny.
2nd prize	...	... (\$2)—J. W. Perry, Nigg P.O.

SALTOUN TO MAIDA.

1st prize	...	... (\$5)—Goordine, Saltoun.
2nd prize	...	... (\$2)—Goorasing, Hogstye.

Ground Provisions.

43. In January the reaping of a manurial trial with sweet potatoes was completed. This trial consisted of three Latin squares of sixteen plots each, and four treatments as follows :—

Control.	
1 cwt. Sulphate of Ammonia per acre.	
2 Do.	do.
3 Do.	do.

As in previous experiments of this nature it was found convenient to divide the produce into marketable and un marketable potatoes and to count only the marketable ones. Whilst it is not considered necessary to give details of yield here the figures showing increases in yield due to fertilizer applications and the increased value accruing thereby may be of interest.

Increased yield of marketable potatoes due to

1 cwt. per acre Sulphate Ammonia	...	530 lbs.
2 Do. do.	...	1,303 „
3 Do. do.	...	1,672 „

Increased number of marketable potatoes due to

1 cwt. per acre Sulphate Ammonia	...	1,506 units.
2 Do. do.	...	3,183 „
3 Do. do.	...	3,626 „

44. All doses gave increases but the most significant increase under the conditions of the experiment was due to 2 cwt. per acre. This is seen from the following table :—

	1 cwt.	2 cwt.	3 cwt.
Value of increased produce at 2 cents per lb. marketable potatoes	\$ 10 60	\$ 26 60	\$ 33 40
Cost of fertilizer	2 25	4 50	6 75
Increased value due to fertilizer	8 35	21 66	26 69

Citrus.

45. Budwood has been obtained from Trinidad for Mr. Chan's nursery and increased interest is being shown by the farmers generally in the cultivation of this crop. The small area of grapefruit planted at Pln. Blairmont during 1931 on lands unsuited for cane cultivation is making fair growth, thanks to the attention given to them by the estate management. During the year under review it was thought advisable to do some supplying and fifty more seedlings were planted. These are doing well. The row of grapefruit established by the Town Council on the back dam of the town in 1931 has made excellent progress. Amongst the plantings in the district the largest is that on the East Bank, Berbice River, at Phlegt Anker. The owner has now 18 acres planted with grapefruit and orange and now carries out his own raising of seedlings and does his own budding.

School Gardens.

46. Two school gardens were registered during the year at Edinburgh and Auchlyne Schools. At Auchlyne a portion of the Whim Sub-station was set apart for the pupils and at Edinburgh a portion of the school compound was fenced and a tool shed and nursery erected. There is a good water supply at both schools. The teachers and boys showed keenness in the project. Their work was satisfactory. At Edinburgh insect attacks were troublesome. Instructions were given to effect control. This always occurs in newly opened land where no cultivation has hitherto been done. The Agricultural Instructor, Corentyne, visited Auchlyne School garden regularly for practical demonstrations and instruction, whilst at Edinburgh this was done by the Agricultural Assistant, New Amsterdam. At each garden records of attendances, sowings and reapings, etc., are kept.

COLONY HOUSE GARDENS AND PRISON FARM.

47. Owing to the scarcity of Prison labour the New Amsterdam Gardens were neglected and the lawns became overgrown. These gardens cannot be properly maintained unless adequate labour is provided, together with necessary assistance for raising seedlings for the flower beds. On the Prison farm some excellent work has been done by the Keeper in the propagation of sweet potato varieties. It is hoped eventually by means of observation and trial to eliminate the non-suitable varieties. There are twenty varieties in all and when the present plots are reaped it is hoped to obtain figures which will form the basis of this elimination. Some good work has also been done in establishing and propagating legumes and especially edible peas and beans. In the prison compound a vegetable garden was

started during the year. A small nursery for seedlings was started, with a result that crops were grown, which were distributed to the various public Institutions in the Town.

Manure was obtained from the Town Council stables.

CO-OPERATIVE CREDIT BANKS.

48. There are eight credit banks in the district, four on the West Coast under the Chairmanship of the Agricultural Superintendent and the other four on the Corentyne under the Chairmanship of the Resident Instructor, Corentyne. Monthly meetings have been held. Attendances of committee members on the West Coast at all events are unsatisfactory and many meetings fell through due to lack of a quorum. It is feared that the heavy rains will affect adversely the collection of loans during the coming years. Only one bank failed to meet its obligations to Government for loans and interest.

MISCELLANEOUS.

49. The rainfall recorded at the Public Gardens, New Amsterdam, was 115.82 inches as compared with 96.71 inches for 1932.

50. *Reports.*—654 items of correspondence were despatched, 315 received and the following reports submitted to the Director :—

- Monthly progress reports.
- Cane seedling reports.
- Reports on competitions.
- Report on Pln. Kingelly.
- Reorganisation of the Prison Farm, with plan.
- Report on seed padi distribution, 1931-33, with map.
- Preliminary statement on areas presumed suitable for citrus.
- Report on rice mills, with map,

51. *Acknowledgments.*—It is a pleasure to record my appreciation of the work of the staff during the year. Sincere thanks are extended to estate managers and staffs and to all agriculturists for many courtesies.

HECTOR MACLUSKIE,
Agricultural Superintendent, Berbice.

January 19, 1934.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE EAST DEMERARA DIVISION FOR THE
YEAR 1933.

CONTENTS.

	PAGE.
GENERAL ...	17
CROP CONDITIONS Sugar ; Rice.	17
EXPERIMENT STATION, GEORGETOWN Ground Provisions and Vegetables ; Tobacco ; Mangoes ; Green Manures ; Fibres ; Fodder Crops.	18
SUB-STATION CECILIA Tomatoes ; Onions ; Soya Beans ; Legumes ; Sweet Potatoes ; Chinese Yams ; Grapes ; Tobacco ; Chilli Peppers ; Sesamum ; Melons ; Truck Produce.	19
DISTRICT WORK Cane Farming ; Rice ; Coconuts ; Ground Provisions and Vegetables ; Lodge Allotments ; School Gardens.	22
AGRICULTURAL EDUCATION Competitions (Rice, Sugar-Cane and Onions) ; Exhibitions (B.G. Workers' League).	24
CO-OPERATIVE CREDIT BANKS ...	26
SEED DISTRIBUTION ...	26
SEED AND PLANT INTRODUCTION ...	27

REPORT OF THE EAST DEMERARA DIVISION FOR THE YEAR 1933.

STAFF.

E. M. Peterkin,	—Agricultural Superintendent.
C. C. Dowding, F.L.S., F.R.H.S.	—Agricultural Instructor, East Coast District.
D. D. Haynes	—Agricultural Instructor, Mahaica-Mahaicony District.
J. Indrobeharry	—Agricultural Assistant, Experiment Station.

GENERAL.

1. During the year the Agricultural Superintendent was absent from the Colony on leave from April 18 to December 31. Of this period, $1\frac{1}{3}$ months were spent going to and from British Honduras, including 18 days spent in that Colony reporting on the possibility of establishing a rice industry for purely local consumption.

2. Mr. J. D. Gillespie, B.Sc., Agricultural Superintendent, West Demerara, supervised the work of the District from April 19 to October 2 when he left the Colony on leave of absence. Mr. L. E. Codd, M.Sc., Plant Breeder, took charge from October 2 to the end of the year.

3. Mr. D. D. Haynes was transferred to act as Agricultural Instructor in West Demerara from October 3, and Mr. C. C. Dowding, F.L.S., F.R.H.S., performed the duties of the Mahaica-Mahaicony District as well as his own from October 3 to the end of the year.

4. The Agricultural Superintendent acted as Deputy Director of Agriculture from January 1 to February 14 during the absence from the Colony on leave of the Deputy Director.

CROP CONDITIONS.

Sugar.

5. The farmers are taking a much keener interest in this crop. The farmers and the management of the sugar estates are now working amicably.

6. The heavy rainfall from November onwards will have a detrimental effect on the young canes. Up to the end of the year it was still raining incessantly.

Rice.

7. The spring crop was poor, owing to late planting and unfavourable conditions. The autumn crop, although planted late in most places, was good. Weather conditions were good until the heavy rains arrived at the end of October just before the reaping was completed; this caused excessive lodging, resulting in the loss by germination of much padi, in some cases amounting to as much as 20 per cent. of the crop; it also increased the cost of the reaping. Padi reaped before the rains gave very high yields.

8. The mills were forced to suspend operations in order to enable farmers to dry some of their padi on the concrete. The uncertainty of the weather in December—when it was difficult to dry steamed padi—is likely to cause a shortage of milled rice during January.

EXPERIMENT STATION—GEORGETOWN.

Ground Provisions and Vegetables.

9. *Bananas*.—The collection was transplanted in January from South Field to North-East and North-West Fields. The following varieties are under cultivation :—

Cinera Seramphur, Rajah (India), Martabanica, Red Fig, Apple, Jamaica, Cayenne, Sucre, Gros Michel, Dwarf, Giant Fig, Congo, Lacatan, Chan-A-Sue (N.W.D.), Almedo, Dacca, Rubra (India), Siam, Ramkela, Palembang, Celat, Serah (Indian Archipelago), Martinique (N.W.D.), Lady's Finger, Red Fig, Red Jamaica, Large Fig, Small Fig, Martaban, Pisang Su-Su (Singapore), Sour Fig and Cocorite.

10. *Plantains*.—The varieties under cultivation in South Field were transferred in January to North-East Field; they are as follows :—

Apple, Surinam, Horse, Giant, Black, Pink and White.

A large number of suckers was distributed during the year.

11. *Onions*.—Three ounces of seed were sown in December, 1933, for distribution in 1934; all of this was totally destroyed by the heavy end-of-year rains.

Tobacco.

12. The demand for tobacco seed has increased, and all of the seed collected from the varieties planted in 1932 has been distributed.

The following varieties have been planted this year for seed :—

Yellow Mammoth, Kentucky One Sucker, Comstock Spanish, White Burley and Hickory Pryor.

The continuous rains at the end of the year retarded them considerably; a large percentage of the plants of Hickory Pryor, White Burley and Comstock Spanish has died. Mosaic had not appeared up to the end of the year.

Mangoes.

13. The grafted mangoes planted in South Field are making satisfactory growth. Fifteen new plants were added during the year. The collection now consists of :—

Julie	...	...	24
Mrs. White	...	...	3
Jamaica No. 11	...	...	5
Mrs. Dare	...	...	1
Graham	...	...	2
Père Louis	...	...	3
Bombay Purple	...	...	2
Bombay (Essequibo)	...	...	3
Peach	...	...	4
Bangalore	...	...	1
D'Or	...	...	3
Ceylon	...	...	1
Colonial Bank	...	...	1
Clementi	...	...	1

Some of the Julies produced a few fruit in February and March, none of the others have fruited yet.

The varieties on the old fruit dam produced very poorly and all the fruit were very acid. The fruit from these trees is deteriorating both in quantity and quality yearly. One Jamaica No. 11 died during the year.

Green Manures.

14. The following varieties are under cultivation :—

Crotalaria spectabilis, *C. usaramoensis*, *C. juncia*, *C. striata*, *C. sp.*, *Canavalia ensiformis*, *C. gladiata*, *Indigofera hirsuta*, *I. endecaphylla*, *I. sp.*, *Dolichos hosei*, *Centrosema pubescens*, *Calapogonium mucunoides*, *Pueraria javanica*.

310 lbs. of seed have been distributed during the year.

Fibres.

15. *Manilla Hemp*.—The dry weather retarded their growth and many clumps died; the remainder are making satisfactory progress. The heavy rains at the end of the year appear to have been beneficial rather than otherwise.

Fodder Crops.

16. The area planted in South Field has been maintained during the year, but cultural operations have not been performed.

Para grass and Wynne grass have practically died out, this is due principally to reaping them with a scythe, cutting them too frequently and too low.

Alysicarpus vaginalis has established itself in patches and is spreading to other beds.

Demerara Primrose is not doing so well where it was originally planted, but is establishing itself on neighbouring beds; it is very obvious that it requires semi-shade.

SUB-STATION CECILIA.

Tomatoes.

17. Plots of the following varieties were planted from seed obtained from Messrs. Sutton & Sons, England; Messrs. Peter Henderson & Co., U.S.A., and Messrs. Ewing & Co., Canada.

The following table gives all data in connection with same :—

Country of Origin.	Variety.	Date Sown.	Date Trans-planted.	Reaping Period.	No. of Stems.	Area. sq. ft.	Yield per plot. lbs.	Yield per acre. lbs.	Prevalence of Blossom-end rot.	Prevalence of Mosaic.
IMPORTED SEED.										
England	...Early Market...	24.4.33	23.5.33	5.8.33 to 7.9.33.	2	720	52	3,148	nil	Slight
Canada	...Bonny Best...	1.5.33	7.6.33	23.8.33 to 28.9.33.	2	480	32	2,904	nil	Slight
Canada	...John Baer...	1.5.33	7.6.33	23.8.33 to 28.9.33.	2	480	14	1,270	nil	Slight
U.S.A.	...Marglobe...	24.4.33	23.5.33	5.8.33 to 7.9.33.	2	480	29	2,631	nil	Slight
U.S.A.	...Bonny Best...	1.5.33	7.6.33	12.8.33 to 28.9.33.	2	480	19	1,724	nil	Slight

SEED COLLECTED AT CECILIA FROM IMPORTED VARIETIES.

England	...Early Market...	24.4.33	23.5.33	5.8.33 to 7.9.33.	2	240	14	2,540	nil	Very bad
U.S.A.	...Marglobe...	24.4.33	25.5.33	8.8.33 to 7.9.33.	2	240	10	1,815	nil	Very bad

The yields this year were very poor, owing to heavy and continuous showers during May, June and July; this prevented many of the flowers setting fruit. Strange to say, not a single fruit was attacked by blossom-end rot. The fruit obtained was of uniform size and quality.

Plots of all these varieties were planted on December 12, 1933, and results of these will appear in the 1934 report.

Onions.

18. Seed obtained from Teneriffe was sown as under:—

Variety.	Date Sown.	Date Transplanted.	Date Reaped.	Area. sq. ft.	Yield. lbs.	Yield per acre, lbs.
White	20.12.32	31.1.33	22.4.33 to 16.5.33.	528	269	22,192
Red	20.12.32	31.1.33	22.4.33 to 16.5.33.	528	319	26,318

Weather conditions were suitable and the yields were better than in previous years.

8 ozs. of seed of the white variety were sown on October 31 and transplanted on December 5 in 900 square feet. The December rains, however, destroyed the entire lot.

Soya Beans.

19. A plot of 825 sq. ft. was sown on December 19, 1932, on soil where soya beans had been grown continuously for 4 years. This did extremely well, giving a yield of 1,503 lbs. per acre.

A plot of 720 sq. ft. was sown on May 20, 1933. The yield was 2,093 lbs. per acre.

Legumes.

20. Large quantities of seed were distributed free; the demand for the edible types has increased considerably.

The varieties under cultivation are:—

Bengal bean, Canavalia, Dwarf and Bush bonavist, Lima bean, Cow pea (edible), Sinebone, Urid and Mung.

A collection of beans was obtained and experimented with, as under:

Country of Origin.	Variety.	Date Sown.	Germination.	Date Reaped.	Area. sq. ft.	Yield. lb. oz.
Puerto Rico	Venezuelan Black Bean ...	16.12.32	Fair	23.2.33 to 3.3.33.	450	1 4
Uganda	Bitango	16.12.32	Poor	22.2.33 to 3.3.33.	575	12
	Magulu Ga Namunye ...	16.12.32	Bad	8.2.33 to 28.2.33.	432	3
	Serere	16.12.32	Poor	18.2.33 to 3.3.33.	432	12
	Kaija	16.12.32	Poor	20.2.33 to 3.3.33.	432	8
	Neavy	16.12.32	Bad	17.2.33 to 28.2.33.	432	3
	Red Mutike	16.12.32	Poor	17.2.33 to 28.2.33.	432	8
	Black Mutike	16.12.32	Bad	18.2.33 to 27.2.33.	432	2
	Ordinary Mutike	16.12.32	Bad	17.2.33 to 27.2.33.	432	3
	Cowpea	16.12.32	Fair	10.2.33 to 27.2.33.	432	14
Nigeria	Bush Lima No. 3... ..	17.12.32	Good	20.2.33 to 3.5.33.	432	1 3
	Bush Lima No. 4... ..	17.12.32	Good	20.2.33 to 29.4.33.	432	1 5
	Climbing Lima Small ...	17.12.32	Good	20.2.33 to 29.4.33.	432	2 0
	Lima Bean	17.12.32	None germinated			
	Small Lima—Rangoon type...	17.12.32	Bad	31.1.33 to 21.4.33.	432	1
	Popondo	17.12.32	Bad	25.4.33 to 29.4.33.	432	1

These varieties were replanted on May 25, but all died with the exception of the Bush Lima No. 3, No. 4, Venezuelan Black Bean and Climbing Lima. Further plots of these were planted in November.

Sweet Potatoes.

21. These have been transferred to Berbice county.

Chinese Yams.

22. These were reaped during March and extended to plots of 576 sq. ft. each on June 7. They have been planted on ridges 3 ft. x 3 ft. apart, after a liberal application of cattle droppings.

Grapes.

23. The vines were pruned on July 31, and a very good crop was promised. This, however, was destroyed by the November rains, the fruit bursting open.

A large quantity of vines grown from cuttings were distributed to farmers.

Tobacco.

24. Seed was collected from the following varieties and distributed to farmers :— Station Standup Burley, Comstock Spanish, Yellow Mammoth, Hickory Pryor. White Burley and Gold Leaf, grown from seed obtained from the Guiana Match Factory were destroyed, as they were heavily attacked by Mosaic.

Chilli Pepper.

25. Of the nine varieties sown in 1932, viz. : Tanjore Long, Tanjore Round, Godavari Big, Godavari Small, Tinnevely, Guntur No. 1, Guntur No. 2 and Jerusalem, only the last-named was lost. Of the remainder, Tinnevely was by far the hottest. They are prolific fruiters. A large number of the peppers was distributed to farmers for seed.

During the year we received the following four new varieties from Ceylon :— Keppitiyawa, Tuticorin A., Tuticorin B. and Jaffna. Of these, only Keppitiyawa germinated and grew. Seed was also obtained from a sample of dried chillies from Canada ; this germinated and has been established.

Sesamum.

26. A plot of 798 sq. ft. was planted on February 17 ; this was reaped early in August, yielding 3 lbs. 2 ozs. of seed. This plot re-seeded itself and a further area was seeded by hand on November 9, giving a total area of 3,520 sq. ft.

Melons.

27. Seed of "Spanish Melon" brought by the Director from Jamaica was planted on November 30. These plants have suffered severely from the rains.

Truck Produce.

28. Seed of the following has been sown in November :—Cauliflower, Radish, Kohl Rabi, Brussels Sprouts, Kale, Swiss Chard, Cabbage—5 varieties and Cucumber—3 varieties. These have suffered badly from the rains.

The total number of visitors to this sub-station during the year was 1,620. His Excellency the Governor also visited the station.

DISTRICT WORK.**Cane Farming.**

29. Much extension work has been done during the year. In Beterverwagting 120 acres of rice land have been put under sugar cane, in Buxton 50 acres, and at

Golden Grove and Nabaclis 30 acres were added to this cultivation. The importance of block farming is still being emphasised and a competition on similar lines to the 1932 one was tried, with the three cane farming villages as a whole instead of each village separately. No entries, however, were obtained. On the whole, satisfactory progress was made.

Rice.

30. The areas under pure line have been maintained and a new area added. Full advantage has been taken of the loan of pure line padi by the Department, and if it had not been for the heavy end of the year rains, the crop on the East Coast would have surpassed all previous years. No. 79 is becoming very popular and is fast replacing Demerara Creole in the esteem of both the farmers and the millers.

31. The five acres of land rented on the front of Pln. Nonpareil were planted this year in No. 79; this yielded 151 bags of padi of 140 lbs. each. This plot is serving an excellent purpose as a demonstration of:

1. Early planting.
2. Planting healthy, strong seedlings.
3. Clean cultivation.
4. Roguing.

Resulting in:

1. Immunity from lodging.
2. Certainty of reaping before the heavy rains start.
3. Increased yields.
4. Improved quality of padi.

32. It is pleasing to note the interest that is taken by farmers on the entire coast, as they pass by train or road, in this plot during its whole period of growth.

The entire supervision was carried out by Mr. C. C. Dowding, the Agricultural Instructor of the district.

Coconuts.

33. The price of coconuts and copra was low for the greater part of the year, with the result that the areas under this crop—with the exception of a few estates—were neglected. The regulation of prices for copra by the Government, however, enabled the farmers to pay some attention to their cultivations.

34. Two minor outbreaks of *Brassolis* took place at Letter T, Anjou, Hamlet Broomlands, Sarah, Bushy Park, Perseverance and Belmont; these attacks were detected early and kept in check; they brought home very forcibly to the proprietors the advantage of maintaining a small observation gang.

The breeding of parasites as a means of control is being very actively pursued at Pln. Letter T.

Ground Provisions and Vegetables.

35. The District Commissioner made a strenuous effort to establish a co-operative marketing agency in Georgetown for the farmers' produce on the East Coast, but so far it has not materialised.

36. *Plantains*.—These did very well. The fruiting period was better distributed this year, which prevented a glut in this commodity in any one month, and better prices were obtained. The Trinidad demand also had a beneficial effect; this was due largely to saner planting, the area being reduced through the villages in-

creasing their sugar areas, and at Hope a large area which was interplanted with coconuts having to be thrown out.

37. *Root Crops*.—The yields were satisfactory, and there was no outbreak of insect pests except a mild attack of cockles in tannias at Clonbrook.

38. *Tomatoes*.—There has been an increase in the interest in and the area under this crop; imported seed supplied by the Department is being used with good results, many farmers adopting the methods used at sub-station Cecilia.

39. *Peas and Beans*.—A large quantity of seed has been distributed from sub-station Cecilia, and considerable interest is being displayed in these legumes. At Buxton, Ann's Grove and Clonbrook villages there is a decided increase in the area grown.

40. *Onions*.—A large number of farmers right through the coast are cultivating onions in a small way, which it is hoped will increase, as the majority obtained excellent yields; this is evidenced by the demand for seed.

Lodge Allotments.

41. There has been a decided improvement in these allotments during 1933, more especially as regards those given out in the southern section to members of the Labour Union. The northern section is not so markedly progressive, but there is a decided improvement.

42. The drainage of the entire area is the most troublesome problem; the side-lines are efficient, but the allotment-holders will not keep them free of weeds; they have also not yet realised the absolute necessity of straight and clean small drains between adjoining plots; every effort has been made to bring this home to them, but very few have taken advantage of this. The heavy rains in December (over 26 inches) have caused flooding and a small amount of damage.

43. The following quantities of seed and planting material have been distributed free during the year:—

Banana suckers (mixed)	...	1,860
Plantain suckers	...	2,150
Cassava sticks	...	3,000
Eddoes	...	900 lbs.
Tannias	...	100 lbs.
Dasheens	...	200 lbs.
Sweet Potatoes	...	18 lbs.
Eschalot	...	24 lbs.
Black Eye Peas	...	200 lbs.
Pigeon Peas	...	19 lbs.
Sinebone	...	1½ lbs.
Tomato seed	...	2 lbs.
Cabbage seed	...	4 ozs.
Mustard seed	...	8 ozs.
Cucumber seed	...	1 lb.
Pumpkin seed	...	1 lb.
Radish seed	...	3 ozs.

and small quantities of bonavist, eggplant, squash, lettuce and pepper seed.

School Gardens.

44. A school garden was started at the Wesleyan school at Buxton in July this year. The site available was anything but ideal, being very low-lying. The land

was tilled, drained and fenced, and covered with a legume—black-eye peas. It has since been re-forked, and beds laid out and planted with the following:—Beet, carrot, brounager, onion, jerusalem artichoke, lettuce, melons, cucumbers, sweet potatoes, mung, cowpeas, and *Canavalia ensiformis* around the borders.

Mr. Dowding, Agricultural Instructor, visits the garden once a week for instructional purposes.

45. The work performed by the children forms part of the school's curriculum. The headmaster takes a keen interest in the work. The produce is distributed among the children who work in the garden. The results so far have been satisfactory. The Department has supplied free the necessary tools and seeds.

The Director and Deputy Director of Agriculture and the Director of Education have paid visits of inspection.

AGRICULTURAL EDUCATION.

Competitions.

46. *Rice*.—During the year two Rice Farmers' Competitions were held in the East Demerara District, one on the Lower East Coast and one in the Mahaica-Abary District, the conditions in each district being as under:—

For the best block of transplanted pure-line seed padi, the area to be not less than half an acre:—

1st prize	...	...	\$ 15
2nd prize	...	...	10
3rd prize	...	...	5

47. The varieties of padi used were Demerara Creole and No. 79. In some cases pure line seed was supplied by the Georgetown Station, but in many instances the seed was grown by the competitor and conformed to the standard of purity required by the Department.

48. The padi blocks were judged on the following points:—

Preparation and seeding of nursery	...	...	25 points.
Cultural operations in field	...	...	20 "
Uniformity of type	...	...	15 "
Control of insect pests and diseases	...	...	10 "
Yield	...	...	20 "
Hand threshing	...	...	10 "

49. There were 60 entries on the Lower East Coast (Kitty-Mahaica): Nonpareil 20, Paradise 18, Cove and John 21, and Helena 1; this was an increase of five entries on 1932. Competition was keen throughout, and all the entrants willingly carried out the instructions given. The plots were very promising, the result of good work and suitable weather conditions; but the heavy and continuous rains which came down just before the grain was ready to be reaped caused most of it to lodge. This reduced the final number of competitors to 18. The standard of work on the plots was a decided improvement on previous years.

50. The prize winners were as follows:—

1st prize	...	(\$15)—Bagwansingh, Cove and John.
2nd prize	...	(\$10)—Karansingh, Nonpareil.
3rd prize	...	(\$ 5)—Algoo, Nonpareil.

Six pure seed certificates were issued to the following:—

Karansingh, Nonpareil; Algoo, Nonpareil; Juradalli, Nonpareil; Hura No. 1, Nonpareil; Rampersaud No. 2, Nonpareil; Bissoon Chand, Helena.

51. In 1932, there were 108 entries in the Upper East Coast competition (Mahaica-Abary); the prolonged spell of dry weather during that year so adversely affected the plots that this year only 30 competitors entered. There is no regular water supply in this district and farmers are entirely dependent on the weather for a good crop. As the early rains suited their purpose, many farmers shied (broadcasted) instead of transplanting from nurseries. The regular competitors at Sophia's Hope, due to their receiving no higher price for hand-threshed padi, decided not to compete this year. The low price for padi obtaining in the district also contributed to the lack of interest. The greatest interest displayed was at De Hoop.

52. The prize-winners were as follows :—

1st prize ...	...	(\$15)—No award (not up to standard).
2nd prize ...	...	(\$10)—Ganess, De Hoop.
3rd prize ...	...	(\$ 5)—R. Madray, Drill.

53. *Sugar-Cane*.—An effort was made in 1932 to run three sugar cane competitions on the co-operative block system in Buxton, Beterverwagting, Golden Grove and Nabaclis villages, but without success. This year every effort was made to run one competition on similar lines to 1932 in these villages, but with no more success. A further attempt will be made in 1934.

54. *Onion*.—Two onion competitions were started in the villages of Buxton and Beterverwagting at the end of 1932 in order to encourage farmers to grow their own seedlings, which had hitherto been done by the Department. The area of each plot was 5 sq. rods.

55. The plots were judged on the following points :—

Preparation of seed beds	...	...	20 points.
Laying out of plot and manuring...	...	...	20 "
Preparation of soil	...	...	20 "
Drainage	...	...	20 "
Freedom from weeds	...	...	20 "

56. There were nine entrants at Buxton. The competition at Beterverwagting fell through for want of entrants. At Buxton, the plots were carefully prepared, well laid out, efficiently drained and well cultivated. The results obtained should do much to encourage the cultivation of onions on the lighter soils in these villages.

57. The prize-winners were as follows :—

1st prize	...	(\$5.00)—J. Marshall.
2nd prize	...	(\$2.00)—R. Butts.
Special prize	...	(\$1.50)—J. Wills.

B. G. Workers' League Exhibition.

58. The Workers' League staged their third exhibition at the Promenade Gardens from August 31 to September 2. The exhibits were more comprehensive and better prepared than previous shows and of a more uniform type.

59. A stand was erected to house a Departmental exhibit. In addition to the principal crops, a special feature was made of edible legumes, tomatoes and fodder crops, budding and grafting, and apiculture. Exhibits were also staged by the Entomologist, Mycologist, Chemist-Ecologist, Plant Breeder and the Rice Grading Officer. The exhibit of tomatoes attracted considerable attention.

60. The Department awarded Diplomas of Merit to exhibits in any way related to agriculture.

61. The cattle exhibited were young animals bred from Government bulls and were of good quality. There were no exhibits of poultry.

CO-OPERATIVE CREDIT BANKS.

62. I continued the Chairmanship of the Plaisance-Sparendaam, Beterverwagting-Triumph, Buxton-Friendship and the Georgetown Co-Operative Credit Banks until April 18, when I proceeded on leave of absence.

Mr. C. C. Dowding, F.L.S., F.R.H.S., acted as Chairman of the Plaisance, Beterverwagting and Buxton Banks to the end of the year, while Mr. J. D. Gillespie, B.Sc., assumed the Chairmanship of the Georgetown Bank until October 2 when he left the Colony on leave; Mr. H. D. Huggins, M.Sc., then acted as Chairman until the end of the year.

63. Monthly meetings were held at each bank; numerous visits had also to be paid to deal with other business. The drive started in 1932 to bring outstanding judgments for unpaid loans up to date by renewing the notes, was continued, and old outstanding loans either put in suit or, where an effort was being made to pay up, renewed notes signed.

64. Mr. Dowding also continued the Chairmanship of the following banks:—Ann's Grove, Golden Grove and Victoria.

SEED DISTRIBUTION.

65. Plants, cutting and seeds of field crops distributed from the Central Station alone during the period under review to farmers and others throughout the colony are given in the following summary:—

Padi	...	...	61,457 lbs.
Peas and Beans	...	...	230 "
Legumes (cover crops)	...	...	310 "
Tobacco seed	...	...	3 "
Tobacco seedlings	...	...	1,000
Banana suckers	...	...	3,560
Plantain suckers	...	...	2,200
Cassava cuttings	...	...	3,200
Artichokes	...	...	24 lbs.
Eddoes	...	...	900 "
Tannias	...	...	100 "
Dasheens	...	...	200 "
Sweet Potatoes	...	...	18 "
Tomato	...	...	6 "
Onion	...	...	83 "
Cabbage	...	...	4½ "
Eschalot	...	...	24 "
Pumpkin	...	...	1 lb.
Cucumber	...	...	1 "
Mustard	...	...	½ "
Radish	...	...	1 "
Papaw seedlings	...	...	50 "

FODDER PLANTS.

Demerara Primrose	...	{	400 plants
			1 pkt. seed
Elephant Grass	...	...	700 cuttings
Guatemala Grass	...	...	2,200 "
Uba Cane	...	...	1,000 "
Wynne Grass	...	...	24 plants
			1 oz. seed

and small quantities of seed of bonavist, eggplant, lettuce, carrot, beet, water-melon, squash and pepper.

The following plants, seeds and cuttings were distributed from Sub-station Cecilia during the year :—

Tomato (fruit)	...	...	172 lbs.
Chilli (fruit) ...	...	...	76 "
Chilli (seedlings)	...	...	2,096
Black Eye peas	...	...	5 lbs.
Cowpeas ...	...	...	4½ "
Bush Bonavist	...	...	6 "
Dwarf Bonavist	...	...	2½ "
White Lima Bean	...	...	5 "
Mung ...	...	...	4 "
Urid ...	...	...	3 "
Venezuelan Black Bean	...	...	1½ "
Soya Bean ...	...	...	5 "
<i>Canavalia ensiformis</i>	...	...	78 "
<i>Canavalia gladiata</i>	...	...	20 "
Chinese Yams...	...	...	6 "
Sweet Potato (cuttings)	...	...	278
Grape vine ...	...	...	63 plants.

SEED AND PLANT INTRODUCTION.

66. The undermentioned seeds and plants were received during the year :—

Tomato "Bonny Best" and "Marglobe"—2 lbs. 14 oz. seed—from U.S.A.
 Tomato "Bonny Best" and "John Baer"—12 oz. seed—from Canada.
 Tomato "Early Market"—2 lbs. 6 oz. seed—from the United Kingdom.
 Collection of Vegetable seed—from the United Kingdom.
 Collection of Vegetable seed—from the U.S.A.
 Chilli Pepper—4 varieties—from the Department of Agriculture, Ceylon.
 Onion—white and red—83 lbs.—from Teneriffe.
 Mango "Peach"—2 plants—from Trinidad.
 Padi—2 varieties from Fiji Islands.
 Padi—6 varieties—from Burma.
 Padi—11 varieties—from India.
 Padi—2 varieties—from Australia.

E. M. PETERKIN,
 Agricultural Superintendent,
 East Demerara.

February 15, 1934.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE WEST DEMERARA DIVISION FOR THE
YEAR 1933.

<http://www.sagepub.com>

			PAGE.
GENERAL	...	...	31
CROP CONDITIONS	...	...	31
Sugar ; Rice ; Coffee ; Cacao ; Tobacco.			
DISTRICT WORK	...	...	32
Sugar ; Rice ; Pineapples ; Tobacco.			
AGRICULTURAL EDUCATION	...	...	34
School Gardens ; Competitions ; District Agricultural Committees.			
CO-OPERATIVE CREDIT BANKS	...	...	35

REPORT OF THE WEST DEMERARA DIVISION FOR THE YEAR 1933.

STAFF.

J. D. Gillespie, B.Sc. Agriculture, (Edin.)—Agricultural Superintendent.

GENERAL.

During the absence from the Colony on leave of the Agricultural Superintendent, East Demerara, from April 19 to October 2, the Agricultural Superintendent, West Demerara, supervised the work in his district in addition to his own duties until his return.

2. The Agricultural Superintendent, West Demerara, was granted six months' leave of absence and left the Colony for the United Kingdom on October 2. The work in the Division was then supervised by Mr. D. D. Haynes, Agricultural Instructor, under the immediate control of the Superintendent for East Demerara; this arrangement continued to the end of the year.

3. The Superintendent was placed in charge of the Department's stand at the B.G. Workers' League Exhibition held in the Promenade Gardens in August. A very comprehensive exhibit was staged of the Colony's agricultural produce attracting a great deal of attention during the three days' exhibition. The collection of the agricultural census data for 1932 was carried out during the year.

CROP CONDITIONS.

Sugar.

4. The area under cultivation with sugar-cane was 15,423 English acres. Of this amount 12,841 acres were reaped yielding 29,848 tons sugar made. The crop on the sugar estates was on the whole good.

Cane farming is not engaged in seriously. At Sisters and Good Intent Villages a few acres are grown and the canes sold to Plantation Wales. A start has also been made at Middlesex in Canal No. 2, where one acre has been put under canes; these will also be sold to Plantation Wales.

5. An outbreak of sugar-cane *Aphis* occurred in September. In conjunction with the Entomologist trials were undertaken at Plantation DeKinderen with various sprays containing nicotine sulphate, derrisol and arboleum. The experiments and results obtained are dealt with by the Entomologist in his report.

Rice.

6. The area under pure line padi has been maintained but has not been increased to the extent that was anticipated; there is a noticeable lack of interest due principally to the fact that in this district high grade padi realises the same price at the mills as the poorer grades.

This question is receiving my attention. The spring crop suffered severely from the dry weather at the end of 1932 in its early growth, this ultimately affected the yields. The autumn crop was an exceptionally good one, but the heavy rains of October—November caused large areas of ripe padi to lodge, resulting in considerable loss by the padi germinating and rotting in the fields.

Coffee.

7. The price paid to local farmers for coffee dropped to 5½ cents per lb.; this resulted in the farmers being obliged to reduce the expenditure on their cultivations. On the whole, however, the interest shown in 1932 has been maintained.

Cacao.

8. With the exception of a few estates on the Demerara River, of which Plantation Dunoon deserves mention, this crop is badly neglected. Witch Broom is a disease very prevalent throughout the cocoa areas.

Tobacco.

9. More interest was taken in the cultivation of tobacco than hitherto. The heavy rains at the end of the year prevented several persons who intended making a trial from doing so. The regular cultivators suffered through the heavy rains.

DISTRICT WORK.

Sugar.

10. The following sugar-cane experiments were carried on during the year in West Demerara in conjunction with the Cane Agronomist:—

In January, one of the series of Imperial Chemical Industries manurial trials was laid down at Plantation Uitvlugt.

In March, a variety trial was laid down at Plantation Wales Bellevue in an attempt to find a variety suited to pegasse lands. This trial included some of the better Indian Canes along with P.O.J. 2878 and 213.

In May, a manurial trial was laid down at Plantation Versailles, the land chosen for this trial was unflooded pegasse and the canes suffered somewhat from drought. In some cases the effect of the application of fertilisers was very successfully marked.

On Plo. Uitvlugt Field 13E, Variety Trial 1932, of "1928 seedlings" plant canes was reaped October 20, 1933. Some of these new seedlings gave promise of being very useful.

Variety Trial—10 Zeeburg 1st Ratoons were reaped on September 5, 1933. The results will be published in Sugar Bulletin No. III. in the press at time of writing.

The manurial trial laid down in 1932 at Plantation Leonora was reaped.

Manurial—Plantation Uitvlugt 75 Zeeburg limestone experiment was reaped on September 7, 1933, whilst Imperial Chemical Industries manurial trial was reaped on April 28, 1933.

11. There was a serious outbreak of Aphids in the district, this was investigated by the Entomologist and various sprays were tested out. There was also in May a heavy attack of caterpillar—*Mocis* sp.

Pineapples.

12. The pineapple concession on the Demerara River was regularly visited. The manurial trial laid down at this concession has convinced the Directors of the Company of the benefits to be derived from the proper application of artificial fertilisers and they intend laying out an exhaustive trial as well as making applications to the rest of the cultivation. Progress there has been satisfactory. Browning, thick core, and the uneven ripening of individual fruit are some of their most important problems.

13. *Manurial Trial 1932-33.*—The results of the first experiment up to October 21, 1933, have been examined statistically and are discussed below.

TABLE I.

Treatments lbs./acre.			Pineapples per 100 plants to 21.10.33.	Cost of Manures.	Value of increased yield.	Profit.
Sulphate Ammonia.	Super- phosphate.	Sulphate Potash.				
A 373	373	306	14.7	\$ 23 40	\$ 29 30	\$ 5 90
B 746	746	612	16.6	46 80	35 90	10 90
C 1,119	1,119	918	25.8	70 20	68 00	2 20
D 746	373	612	28.5	41 80	77 40	35 60
E 746	746	306	17.6	35 90	39 45	3 55
Control nil	nil	nil	6.3	...	...	...

14. Had it been possible to carry out the experiment as it was originally designed there is little doubt that the increase of fruit production would have been greater. Apart from the actual yields obtained it appears that treatment D hastened maturity while treatment E retarded ripening. It appears from the results of this experiment that the crop requires a high potash—low phosphate mixture.

15. *Second Manurial Trial.*—A further manurial trial was laid down by the Department in August, 1933. The experiment was in the form of a latin square and the experimental details were as follows:—

Area of Experiment: Roughly one acre.

Size of Plots: $\frac{1}{40}$ acre.

Lay Out: 6 x 6 latin square.

Plot Treatments:

(A) Control—No manure.

(B) Basal dressing.

(C) Basal dressing plus fertiliser W 9 months after planting.

(D) Do. do. X do.

(E) Do. do. Y do.

(F) Do. do. Z do.

16. The basal dressing of plots (B) to (F) consisted of $6\frac{1}{4}$ lbs. of rock phosphate per plot applied shortly before planting and each plant received $1\frac{1}{2}$ ozs. of cotton seed meal and $\frac{1}{3}$ oz. of sulphate of potash, assuming that the spacing is 10,000 plants per acre or 250 plants per plot. Whatever the spacing, the basal dressing per acre should consist approximately of 1,000 lbs. of cotton seed meal, 250 lbs. rock phosphate and 180 lbs. of sulphate of potash.

17. The fertiliser dressings W—Z were applied nine months after planting. Their composition was decided later and were influenced by the results of the first manurial trial. Just before blossoming all plots were divided into half plots and at blossoming one half of each plot, randomly selected, was dressed with a fruiting application.

Rice.

18. Six and a quarter acres of Demerara Creole were grown by the Department at La Jalousie, the return from this was 198 bags of padi. This will be used for distribution for the 1934 autumn crop. In this connection a system of loans was introduced with the object of increasing the stock of pure line seed padi. One hundred and seventy-seven bags were distributed in the district. Eighty bags were purchased by the La Grange Village Authority and distributed by them to the villagers. Much good could arise from this example if, other village councils in rice growing areas would appreciate the importance of pure line seed padi. A variety trial was carried out at La Jalousie. Two latin squares of six replications of each of six different varieties were laid out. Results of this will be included in the *Agricultural Journal* (Vol. V., No. 1) for March, 1934.

19. *Rice Grading.*—3,983 bags of rice were graded by the Agricultural Officer during 1933.

Coffee.

20. The coffee pruning demonstration plot laid down at the head of No. 2 Canal was discontinued through lack of funds. This is regrettable as there is a great diversity of opinion as to the best time and method of pruning. The price of prepared coffee continued to be low, so that farmers were not in a position to extend their cultivation. On the whole, the existing areas were fairly well looked after, although a certain number of farmers are turning their attention more towards provision growing due to the opening up of new areas by the Canals Polder Authority.

Tobacco.

21. Now that the Guiana Match Factory has fixed definite prices for different grades of leaf there should be an improvement in the quality of the product grown.

Much interest is being shown and, had it not been for the heavy rains, there would have been several attempts made by new cultivators who had obtained seed for this purpose. It has not yet been fully realised to what extent keenness on the part of the cultivator decides the issue in favour of success with this crop.

AGRICULTURAL EDUCATION.

School Gardens.

22. The Juvenile Agricultural Club at Den Amstel has ceased to function. It is to be regretted that a co-operative venture of this kind should be allowed to die so quickly.

23. A school garden was started in November at the Blankenburg Congregational School in the site of the above club garden. Great interest is shown by both teachers and pupils. A garden has also been started at Stewartville in March; the progress here has been very satisfactory. Here can be seen the result of a conscientious schoolmaster, a sympathetic manager, and attentive pupils. Few gardens can show such progress in such a short time.

Competitions.

24. The following agricultural competitions were held in the West Demerara District during the year 1933 :—

For the best block of transplanted pure line seed padi (Autumn Crop), the area to be not less than half an acre on the East Bank, Demerara (Craig Village upwards), on the West Coast (between Vreed-en-Hoop to Hague and Hague to Parika) and on the Island of Leguan.

1st prize	...	...	...	\$ 15
2nd „	...	...	...	10
3rd „	...	...	...	5

For the best miscellaneous farm between Vreed-en-Hoop and Wales, the area to be not less than half an acre.

1st prize	...	...	...	\$ 15
2nd „	...	...	...	10
3rd „	...	...	...	5

25. The padi blocks were judged on the following points :—

Preparation and seeding of nursery	...	25 points.
Cultural operations in the field...	...	20 points.
Uniformity of type	...	15 points.
Control of insect pests and diseases	...	10 points.
Yield	...	20 points.
Hand threshing	...	10 points.

Reaping had to be done only when the crop was uniformly mature; padi reaped was to be sold as far as possible for seed purposes whilst all competitors who had purchased pure seed from the Department were given a "pure seed certificate."

26. Cultivators have pointed out that it is difficult to grasp the advantages of roguing good cultivation previous to seeding, good drainage, careful lay out, etc., etc., and such points as are stressed in the competitions. The farmer can see the benefit and will buckle to with enthusiasm if he is guaranteed the prize but the idea of better cultivation for the sake of the increased return alone is incomprehensible. The closing date for the rice competition entries was put forward this year so that

the Superintendent might be able to see the competition plots from the early stages but many cultivators did not enter until after the crop had been planted. This was most unfortunate as nursery practice is very important in rice cultivation.

27. Due to this lack of interest no awards were made on the Upper West Coast and East Bank ; in Leguan only one prize was awarded, the third. It is regrettable that this effort on the part of the Department is not appreciated, especially when it is noted that more rice competitions were run in this district than in any other in the Colony. The following were the prize-winners on the Lower West Coast :—

1st prize	...	(\$15)—Hansraj, LaJalousie.
2nd „	...	(\$10)—Rajcoomar Do.
3rd „	...	(\$ 5)—Dhanpat Do.

28. The miscellaneous farms were judged on the following points :—

Drainage	...	30 points.
General layout and state of cultivation	...	30 „
Condition of crops, control of pests and diseases	20	„
Livestock (including poultry) ...	...	20 „

29. As in the case of the rice competitions very little interest was shown in these competitions and only five entries were received. This is extremely disappointing and it is hoped that farmers next year will evince greater interest in entering their plots for competition. The following were the prize winners :—

1st prize	...	(\$15)—J. C. daSilva, Pouderoyen.
2nd „	...	(\$10)—Arnold Greene, Bagotville.
3rd „	...	(\$ 5)—William Griffith, LaGrange.

District Agricultural Committees.

30. A District Agricultural Committee for West Demerara was formed in 1933 having for its object amongst other things the development of food production and new agricultural products of export value, while it is intended that the Committee should investigate the various agricultural possibilities of the District. The Committee consists of the following members : Director of Agriculture (Chairman), District Commissioner, District Agricultural Superintendent (Secretary), Hon. J. Bahadur Singh, Messrs. A. Murison, R. B. Hunter, R. P. Carryl, J. C. Da Silva, W. Ramdeholl, J. W. Jackson and A. Rayman. It is hoped to hold a meeting early in 1934 when various points will be raised.

CO-OPERATIVE CREDIT BANKS.

31. The six co-operative credit banks in this district continued to be under the Chairmanship of the Agricultural Superintendent until October 2, when he left the Colony on leave of absence. Mr. H. D. Huggins, M.Sc., acted as Chairman from that date to the end of the year. Usual monthly meetings were held at all the banks during the year.

32. It is safe to say that these banks are filling a very definite and useful purpose although most of them are greatly hampered. They are strangled by long outstanding and dead loans given out by previous Chairmen, secondly, by the fact that the work done on the part of the Committee members is entirely voluntary, the Secretary is only a part time servant and thirdly the Chairman has six banks apart from his other duties. The monthly meeting of each bank occupies half a day. The loans granted have to be paid on another half day with the result that great dissatisfaction is felt by the members of certain banks regarding the issue of loans. The banks doing the best work are those situated on the West

Bank, Demerara, but the work done and time given up by the members of the various Committee of Management is insufficiently realised or appreciated by the members of these banks generally.

JAMES D. GILLESPIE,
Agricultural Superintendent,
West Demerara.

April 30, 1934.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE ESSEQUIBO DIVISION FOR THE YEAR 1933.

CONTENTS.

	PAGE.
GENERAL	39
CROP CONDITIONS	40
Rice; Ground Provisions and Vegetables.	
HENRIETTA EXPERIMENT STATION	40
Rice; Cover Crops; Onions; Sweet Potatoes; Other Crops (Tomatoes, Pineapples, Sesame).	
DISTRICT WORK	42
Rice; Rice Grading; Emergency Agricultural Loans; World's Grain Exhibition.	
AGRICULTURAL EDUCATION	44
Competitions (Rice, Miscellaneous Farms, Onions), School Gardens.	
ANNA REGINA ESTATES	47
Staff; General; Machinery Trials (Rice Mill; Power Aspirating Machine; Threshing Machine; Padi Seed Drill).	
MISCELLANEOUS	48
Surveys; General; Reports.	

REPORT OF THE ESSEQUIBO DIVISION FOR THE YEAR 1933.

STAFF.

A. deK. Frampton, C.D.A.—Agricultural Superintendent.
A. A. Abraham —Assistant Superintendent.
A. W. Sears —Agricultural Instructor, Wakenaam.

GENERAL.

The Agricultural Superintendent proceeded on leave of absence on December 3, 1932, and returned on June 4, 1933.

The Assistant Superintendent was granted three months' local leave of absence as from December 16, 1933.

2. Prior to the Agricultural Superintendent proceeding on leave the Administration of the Bush Lot Settlement and Anna Regina Estates was handed over to the District Commissioner, Essequibo. The district work was taken over by the Assistant Superintendent. During March, 1933, Government resumed control of the Bush Lot Land Settlement and Anna Regina Estates and the Deputy Director of Agriculture was placed in charge during the absence of the Agricultural Superintendent.

3. The chief work during the year has again been in connection with the Bush Lot Land Settlement and the Anna Regina Estates. Unfortunately the water supply failed in the early part of the year and the spring crop was not planted except on the low lying land which could be irrigated. Owing to the poor prices realised for padi and the lack of employment on the coast many of the farmers left to seek work elsewhere and reduced their cultivations in consequence. The acreage planted was reduced by 200 acres. The total area planted including the Bush Lot Settlement was 1,000 acres. Approximately 70 acres of old land, in addition to the 200 referred to above, were thrown out of cultivation as the yields obtained were below the average. This area will be left abandoned for a year.

4. Two school gardens were started during the year, one at Suddie, Essequibo, and the other at Wakenaam. A demonstration garden was also laid out in Wakenaam and this has proved of great benefit to farmers by the distribution of seeds and plants and demonstrations given. Extensive tours have been made throughout the District and in Wakenaam by the Agricultural Superintendent and the Assistant Superintendent. Special attention has again been paid to the growing and distribution of pure line seed padi.

5. The high standard of quality of the Essequibo padi has been maintained, and there has been a further improvement over last year in Wakenaam. The whole of the Essequibo District may now be said to be under pure line seed padi; in some areas extra attention has to be paid to roguing as the undesired types are not quite eradicated. These areas are being carefully watched with a view to preventing deterioration in quality. There is so much interchange of seed between neighbouring estates that any deterioration in quality in one area may spread to adjoining lands. Although farmers recognise and appreciate a good sample of seed padi, if they are in a hurry to sow seed they are inclined to set the first available rather than wait and obtain good quality grain.

6. Seed padi was distributed under two systems during the year viz., (i) by loans and (ii) by cash sales. The system of loaning seed to be repaid in padi (if of the required standard) worked well in Wakenaam where most of the farmers are independent of any proprietor. Under the two systems of distribution 188 bags of 140 lbs. of seed padi were distributed from the Henrietta Station. The

amount distributed was small owing to the failure, through lack of water, of the 1933 spring crop at the Henrietta Station. Distribution was made from the stocks of the 1932 autumn crop.

The autumn padi crop at Henrietta was very badly damaged by the heavy rains during the ripening and harvesting period. The crop was estimated at 170 bags but only 88 bags of 140 lbs. were reaped. All of this padi has been stored for distribution in the District with the 1934 autumn crop.

7. The Chairmanship of the local credit banks was taken over by the Assistant Superintendent during the absence on leave of the Agricultural Superintendent. The latter resumed the chairmanship on his return. Collection of loans was poor, though outstanding interest has been paid up fairly well. Special meetings have been held to decide on action to be taken in the case of long overdue loans. Prosecution has been stayed in many cases where interest has been paid up to date and promissory notes renewed.

CROP CONDITIONS.

Rice.

8. No improvement in price conditions in the District can be reported. Prices of all commodities again fell, and this factor together with loss of crops due to the bad weather, has left the Essequibo farmers worse off than at the end of 1932. The chief crop of the district is padi. The price fell to a new low level during the year, ranging between 72 cents and 84 cents per bag. On some estates \$1 per bag was paid at the commencement of the autumn crop but this price was not maintained except on the Government estates at Anna Regina. The spring padi crop was a partial failure owing to the lateness of the December 1932 rains. The autumn crop was harvested under very trying weather conditions; the rains were so excessive that approximately 30 per cent. of the crop was lost, and 15 per cent. very badly damaged. These conditions have left the farmers very badly off, as they were unable to pay off their debts for shop goods, etc., and many of them still owe money from 1932. The area under plant padi for the autumn crop was reduced slightly as farmers gave up some of the land, saying that the cultivation did not pay. During the growing period many went away to work on sugar estates and in the diamond and gold fields.

Due to the very unfavourable weather conditions during the autumn crop harvest and the resultant damage to padi the quality of rice made in the District has suffered, and rice of super grade was not made in such large quantities as formerly.

Ground Provisions and Vegetables.

9. Prices for provision crops remained at a low level until the end of the year, when owing to the damage resulting from the continuous heavy rains, supplies became limited, and prices improved slightly. With the purchasing power of the people reduced through low prices for padi and lack of employment no permanent improvement can be looked for.

HENRIETTA EXPERIMENT STATION.

Rice.

10. Two experiments were conducted on the Henrietta Station with the autumn crop, viz., (a) Variety trial and (b) graded seed test.

In the variety trial the following six varieties were tested: Blue Stick, No. 79, Kalyaman, Ramcajara, Demerara Creole and H. 7.

11. The mean yields given in lbs. per acre are shown below :—

<i>Variety.</i>		<i>lbs. per acre.</i>
No. 79	...	3,320
Blue Stick	...	2,786
Kalyaman	...	2,652
Demerara Creole	...	2,638
H. 7	...	2,626
Ramcajara	...	2,478
P = 0.05 (significant difference)	...	300

12. It will be seen that No. 79 gave a significantly higher yield than all other varieties, but it is doubtful if the increase is sufficiently large to justify its substitution for Blue Stick which variety is well established in the district and makes good quality rice. Hand beating is practised almost entirely on the coast, and as No. 79 is very much harder to thresh in this manner, it may be extended in those areas which practise bull-mashing. It is proposed to lay down during the next crop some observation plots of No. 79 in different parts of the district. Comparison of yields with pure line Blue Stick will be made and milling trials will also be carried out.

13. The graded seed trial experiment was laid down to see if higher yields were obtained from the use of machine graded padi. Four grades were tried :— (1) Large ; (2) Medium ; (3) Small ; (4) Unseparated.

14. The following figures give the yields in lbs. per acre for each grade of seed tried :—

<i>Grade of seed.</i>		<i>lbs. per acre.</i>
Large	...	2,466
Medium	...	2,478
Small	...	2,540
Unseparated	...	2,482
Significant difference (P = 0.05)	...	238

15. From the statistical results it will be seen that no significant differences in yield were obtained from the various grades of seed. It is thought, however, that a better milling type giving a greater return of rice to padi may result from growing No. 1 machine graded seed and field trials will be laid out in different centres to try this out.

Cover Crops.

16. Little headway has been made with these crops, owing to the partial abandonment of the provision cultivation due to low prices. Black eye peas is the most successful cash cover crop grown and farmers in Wakenaam did fairly well from its sale locally. A new cover crop *Calapagonium muconoides* is being tried out on the Bush Lot demonstration garden.

Onions.

17. In view of the interest shown by farmers in the Essequibo District as indicated by the large quantity of seed distributed special demonstrations were made during the year. Two demonstration plots were also laid down on the Bush Lot Land Settlement to test the results obtained by the application of pen manure and artificial manure. Unfortunately, owing to the arid conditions which prevailed after the plots had been laid out, the tests gave no results.

Onion competitions, to which further reference is made in paras. 44-46, were also organised.

Sweet Potatoes.

18. The Barbados sweet potato cuttings were again extended during the year and distributed to farmers. They have done particularly well in Wakenaam.

Other Crops.

19. *Tomatoes*.— $10\frac{1}{2}$ ozs. of seed were distributed. Several varieties were tried out and the seed distributed to farmers.

20. *Pineapples*.—The collection of pineapple varieties was moved to the Bush Lot sand reef during the year. A new variety of pineapple from Malaya named "Queen" was added to the collection. The pineapples have not fruited as yet.

21. *Sesame*.—The cultivation of this crop was started during the year for the propagation of seed.

22. The demonstration garden (adjoining the school garden) in Wakenaam has proved of great benefit to farmers, especially in connection with onions. The cultivation of garden crops is not appreciated by the average cultivator, but it is hoped to extend this type of cultivation especially with saleable crops as tomatoes and onions.

DISTRICT WORK.

Rice.

23. With the 1933 autumn crop, a seed farm was started in Wakenaam Island under the control of the Department of Agriculture. The padi reaped was of good quality and has been stored for eventual distribution during 1934. It is thought that this padi together with the seed returned under the loan system should be sufficient for the Island's requirements. At Johanna Cecilia the demonstration plot laid out has served as a seed supplying centre for the neighbouring estates.

24. Seed padi has been distributed under two systems this year by loans and cash sales. Under the loan system a farmer was given a quantity of seed and signed an agreement whereby he returned a quantity plus a certain amount for interest. In this way, providing the padi harvested was of good quality, there would always be an assured supply of seed for distribution. If the padi was not up to the required standard then the farmer had to pay cash at the rate of \$1.20 per bag. This system worked well particularly in Wakenaam, but unfortunately weather conditions were so bad that little of the padi could be taken over, most of it getting water soaked. Crop losses were heavy and farmers were also unable to pay cash for the padi. The debt has therefore to be carried forward.

25. Cash sales is the usual system practised on the coast. Proprietors purchase seed for their estates, and give it out on loan to specially selected farmers. These plots are inspected by the Agricultural Officers and the padi harvested purchased and reserved for seed purposes. It is then either resold or loaned to the ordinary estate farmers. In this way a proprietor can keep his estate with an assured seed supply. Seed for his own private farms is purchased annually thereby reducing the chances of deterioration.

26. The standard of purity is well maintained throughout the District, but more difficulty is experienced where a "lameira" or drop seed crop is taken in the spring. In this case no cultivation is carried out with the crop and undesirable types are likely to appear, making roguing more necessary in those areas with subsequent crops. With continual supplies of pure seed, however, provided the farmers do not receive seed for planting from the "lameira" crop, the undesirable types of padi should soon be stamped out. In times of low prices as at present, it is difficult to persuade farmers to rogue their plots. Their argument is that the present prices paid for padi allows no margin for extra work of this nature. Furthermore, except in a few cases, higher prices are not paid for a better quality padi. Where this is given farmers exercise some care in roguing their plots, but the practice is not general. Another factor that is detrimental to the production of good quality padi is that at crop time the millers are anxious to obtain their padi stocks as early as possible, and appoint buying agents throughout the District, thus quality is foregone for quantity.

27. The private seed farm system was tried in Wakenaam but without much success, as farmers lease land under a different system and are financed largely, by independent rice millers instead of the landlord as on the coast. Thus the padi harvested is carried straight to the millers and not stored for seed purposes. The rice millers, however, now appreciate the value of good padi from a milling point of view and many have taken to reserving good quality padi for seed purposes, and this is distributed to farmers at sowing time when making cash advances. Some of the Wakenaam millers have bought padi from the Anna Regina estates for this purpose, when the Department has been unable to supply from Henrietta stocks. The Department has also been able to advise millers where the best padi can be purchased for seed purposes.

28. To ensure a good seed supply for Wakenaam a four acre block was planted under the control of the Department. The seed was supplied by the Department and regular visits of inspection were made during the growing period, roguing was carried out under the direction of the Department. The block yielded a good sample of seed padi giving 90 bags of 140 lbs. This has all been stored in good condition and will be distributed for sowing the 1934 autumn crop. Most of this seed has been booked already.

29. There has been a great improvement in the general quality of rice made in the District since pure line padi became firmly established. Wakenaam mills have also improved the quality of rice milled, but unfortunately, the rice, though made from good quality padi does not reach super standard. It is thought that the practice of bull mashing is responsible for this as first quality padi from Wakenaam has been shipped to the coast and milled, but even then the rice has not been up to the coast standard. The bull mashed padi was very dirty, and it was necessary to wash it thoroughly before soaking. The estates' private seed farm system has continued to work well on the coast, especially at Plantation Affiance, where a seed selecting machine has been installed. Some excellent quality Blue Stick padi was reaped on the Anna Regina estates with the 1933 spring crop. Some of this padi was resold to proprietors and millers on the Coast and in Wakenaam, and much of it was used for seed purposes. It is estimated that at least 200 bags were used in this way. In this connection it is interesting to quote the Director of Agriculture's Annual Report for 1929, para. 77, in which it is stated, referring to the purchase of the Anna Regina estates by the Colonization Committee, "this estate had the reputation of producing a low grade of padi compared with that grown on the better known rice estates of the District." At the present time it may be stated, due to the campaign for the distribution of pure line padi, that the Anna Regina estates produce the best padi in the district and that buyers are anxious to purchase from these estates.

Rice Grading.

30. Sampling of rice intended for export has been continued. It was hoped to export rice direct from the Coast and Wakenaam by the Trinidad Government Steamer s.s. "Trinidad." Unfortunately this project had to be abandoned as millers were unable to guarantee shipment due to the bad weather conditions which held up milling operations. It is hoped that millers will be able to make direct shipments later.

Emergency Agricultural Loans.

31. General agricultural conditions pertaining on the Essequibo Coast, prior to the planting of the autumn padi crop were serious due to the decline in the price of rice and the consequent fall in the price of padi. To alleviate the position, Government decided to consider assistance being given to the cultivators to enable them to carry out their cultivations if the proprietors on their part agreed to make concessions to the tenants. A committee of which the Deputy Director of Agriculture was Chairman, was appointed to consider applications for loans and to make recom-

mendations in connection with the amounts to be granted. These "Emergency Agricultural Loans," as they were termed, have resulted in a sum of \$2,710 being granted for the relief of the estate cultivators generally.

World's Grain Exhibition.

32. The World's Grain Exhibition was held at Regina, Canada, in 1933, and it is pleasing to note the success obtained by Essequibo entrants. In the early part of the season notice was given to all estate proprietors and padi growers on the Coast and in Wakenaam that samples of raw padi for the competition at Regina would be forwarded by the Department of Agriculture. Entries were received from the following estates:—Plantations Perseverance, Spring Garden, Johanna Cecilia, Coffee Grove, Hibernia, Zorg and Cullen on the Essequibo Coast and Plantation Good Success in Wakenaam.

33. The following obtained awards:—

Raghoonandan Maraj, Perseverance	...	4th prize (\$90)
T. Sue, Spring Garden	...	7th " (\$30)
Ramlakhan Singh, Good Success	...	13th " (\$12)
Rashbharry & Co., Johanna Cecelia	...	17th " (\$8)

34. It was very gratifying to note as a result of the pure line seed padi campaign which has been pursued throughout the District that four of the entrants obtained prizes, and that Raghoonandan Maraj, of Plantation Perseverance, who obtained the fourth place, was placed first of any British Empire entry, Siam taking the first three places. The padi samples sent were not specially grown but were taken from the padi stored in the various bonds, the variety being Essequibo Blue Stick grown originally from seed raised on the Experiment Station, Henrietta. The result of the competition caused great enthusiasm in the District and has done much to further the interest of estate proprietors and padi growers in the use of pure line seed padi.

AGRICULTURAL EDUCATION.

Competitions.

35. The following agricultural competitions were held during 1933:—

(1) For the best block of transplanted pure line seed padi (autumn crop) on the Essequibo Coast and in Wakenaam Island the area to be not less than half an acre.

1st prize	...	...	\$ 15
2nd "	...	...	10
3rd "	...	...	5

(2) For the best miscellaneous farm on the Essequibo Coast from Affiance to Sparta, the area to be not less than half an acre.

1st prize	...	...	\$ 15
2nd "	...	...	10
3rd "	...	...	5

(3) For the best block of onions grown from seed obtained from the Department of Agriculture in the Essequibo Coast and Wakenaam Island, the area to be not less than five square rods.

1st prize	...	...	\$ 5
2nd "	...	...	2

36. Points were awarded as follows :—

(a) For the padi competitions, Essequibo Coast and Wakenaam Island :—

Preparation and seeding of nursery	...	...	25 points.
Cultural operations in the field	...	...	20 "
Uniformity of type	...	...	15 "
Control of insect pests and diseases	...	...	10 "
Yield	...	...	20 "
Hand threshing	...	...	10 "

(b) For the miscellaneous farm, Affiance to Richmond :

Drainage	...	...	30 points.
General layout and state of cultivation	...	...	30 "
Condition of crops, control of pests and diseases	...	...	20 "
Livestock (including poultry)	...	...	20 "

37. *Padi competition—Essequibo Coast.*—The competition was well supported this year and entries were received from all padi areas on the Coast, extending from Supenaam to Better Hope. The total number of entrants received was 194 as compared with 144 in 1932 and 70 in 1931. This was very satisfactory not only in the number of entries but also because pure line seed plots are now established throughout the whole padi growing area on the Coast. Most of the nurseries were well laid out and much interest shown in the cultivation but unfortunately interest began to wane when it was learnt that there would probably be a further drop in the market price of padi at harvest time. Consequently, many competitors neglected their cultivation and paid very little attention to roguing their plots, and had to be eliminated from the competition. It is, however, pleasing to report that those who reached competition standard did good work in maintaining a pure stand. This was most marked at Johanna Cecilia, Riverstown and Henrietta.

38. The final prize-winners were as follows :—

1st prize	...	(\$15)—Ganga Persaud, Johanna Cecilia.
2nd prize	...	(\$10)—John Sookhai, Henrietta.
3rd prize	...	(\$5)—Lacknaught, Riverstown.

39. *Padi Competition—Wakenaam Island.*—In this competition it is also pleasing to report that the entries have again increased. The total number received (from all parts of the islands) was 71, an increase of 24 over 1932. On the whole competitive plots were well maintained from the setting of the nurseries up to harvest. The chief fault in this competition, as on the coast, was lack of proper attention to roguing. Instruction and demonstration in this work were given but in many cases the work was neglected when it was heard that the price offered for padi was likely to reach a new low level. Farmers in Wakenaam generally realise that higher yields are obtained from the use of pure line seed padi but argue that a better quality padi should receive higher prices, since Wakenaam now makes some very good No. 1 and 2 quality rice where only No. 3 was made hitherto. The final prize-winners were as follows :—

1st prize	...	(\$15)—Ramcharan Sookhai, Zeelandia.
2nd prize	...	(\$10)—Seepersaud, Arthurville.
3rd prize	...	(\$5)—Dyall, Marionville.

40. The competitions were all commenced before the Agricultural Superintendent returned from leave and the Assistant Superintendent carried out this work. It is due to his energy and interest in the matter that there has been an increase in the number of entrants in each division.

41. The competitors in both rice competitions reached a high standard in all the operations for which marks were awarded and careful attention was paid to instructions given. An average of six visits was paid to each plot at different

stages during the crop. Instructions were given on each visit in connection with the setting of nurseries, roguing and control of pests and diseases. It is evident that the poor prices realised for padi are having their effect on the cultivations. Farmers generally realise that a pure strain of padi yields a better return than ordinary seed, but on account of the low prices which offer no inducement for greater attention to the crop, are not discriminating in the selection of seeds for sowing. It has been pointed out, however, that if a good strain of padi is not maintained the quality of rice made will deteriorate and in consequence prices may become depressed still further. It is unfortunate that there is little selection done when padi is being purchased, and therefore no extra encouragement is given to those farmers producing a high grade of padi. On some estates where the proprietors are giving every encouragement to their farmers, a good quality of padi is being maintained. Those entrants whose padi was of good quality, but who failed to obtain prizes have been awarded pure seed certificates issued by the Department; eleven were given on the Essequibo Coast, and five in Wakenaam.

42. *Miscellaneous Farms—Essequibo Coast.*—This year it was encouraging to report that nine entries were received for the competition in this section. None were received last year. This was the outcome of the campaign undertaken to encourage the cultivation of ground provisions. An effort is being made to get cultivators to take up a farm of sufficient size to supply their household requirements. If profitable, the cultivation can always be extended.

43. The final prize-winners were as follows :—

1st prize	...	(\$15)—E. Bowen, Henrietta.
2nd prize	...	(\$10)—Boodhosing, Colombia.
3rd prize	...	(\$5)—G. Ceaser, Windsor Castle

44. *Onion Competitions—Essequibo Coast and Wakenaam Island.*—The rules governing this competition were as follows :—The nurseries had to be properly prepared, seed was to be sown in rows not less than four inches apart and seedlings transplanted at five weeks old. The beds had to be prepared to meet the Department's requirements and all cultivations kept free from weeds, whilst it was imperative that the Agricultural Officer be notified of the date of reaping.

45. The arrival of the onion seed, unfortunately coincided with the harvest of the autumn padi crop, and the competition did not meet with much success. Attempts were made, however, to encourage the cultivation of the onions after the padi crop was in, but owing to the very dry weather it was not very successful. Seventeen entries were received in Essequibo, and seven in Wakenaam. The plots were regularly visited and during the course of inspection instructions were given in regard to the cultivation. In Wakenaam the Agricultural Instructor grew a special demonstration plot, which proved of great assistance to farmers.

46. The final prize-winners were as follows :—

ESSEQUIBO COAST.		
1st prize	...	(\$5)—Ramsaroop Maraj, Coffee Grove.
2nd prize	...	(\$2)—Ramroop, Anna Regina.

WAKENAAM ISLAND.		
1st prize	...	(\$5)—A. Thrope, Sans-Souci.
2nd prize	...	(\$2)—A. Jack, Marionville.

School Gardens.

47. Two school gardens were started during the year at St. John's School, Suddie, and Sans Souci Wesleyan School, Wakenaam. A supply of tools was received and the elder boys of the school have been given regular instruction, and attended classes in practical gardening. All the work is done by the pupils, assist-

ance only being given with the heavy work such as initial forking. The gardens have done very well indeed and some produce has been available for the boys to sell or carry home.

The following crops have been grown:—Border crops such as pigeon peas, cover crops such as black eye peas and bed crops, viz.: ochroe, tomato, boulanger, pepper, cucumber. Classes have been well attended and the boys have made good progress.

48. The gardens are divided into three sections:—

- (i) Demonstration.—Here the various crops are grown and instructions are given in their cultivation.
- (ii) Community.—Here the pupils all work together, still under direction.
- (iii) Individual beds.—Where the pupils carry out what they have been taught in the other sections.

Regular visits of inspection and instruction have been made by the Agricultural Officers. Seeds and plants were supplied by the Department of Agriculture and the gardens were making good progress, but unfortunately the continuous heavy rains at the end of the year put a stop to gardening and spoilt the cultivation.

ANNA REGINA ESTATES.

Staff.

H. C. Jaisingh—Field Overseer, Anna Regina.
A. S. Khan —Book-keeper and Cashier, Anna Regina.
N. Alli —Assistant Book-keeper, Anna Regina.

These estates comprise the following sections:—

- 1. Bush Lot Land Settlement.
- 2. Anna Regina (two sections).
- 3. Henrietta.
- 4. Richmond (two sections).
- 5. La Belle Alliance (two sections).

General.

49. All development works on the estate had been completed during 1932; the total padi land on the estates during 1933 was 1,270 acres. The spring crop was a failure due to the lateness of the rains in December, 1932. A little "lameira" padi was harvested, and this was sold to rice millers on the Coast and in Wakenaam Island. Many of the tenants from the estates and the Bush Lot Settlement went away and worked on sugar estates during the spring crop period.

50. Due to the drop in the price of padi only 1,000 acres of padi land were planted on the Anna Regina estates and Bush Lot Settlement. Many farmers reduced their cultivations as they contended that it no longer paid to grow large acreages.

The autumn padi crop promised to be a good one and was purchased by a local firm. Shortly after harvest commenced the rains started and practically the whole area was badly damaged. The quality in most cases was so bad that the padi could not be purchased and buying was stopped. The bulk of the padi was too badly damaged and wet to take over for rents and advances, and a great deal of estate revenue had to be left outstanding. From the total estates' acreage only 6,300 bags were purchased as against 16,024 from the 1932 autumn padi crop. The total loss was estimated at 3,000–4,000 bags. The losses sustained and poor prices realised for the crop had a very depressing effect on the farmers, but early preparation was made for planting the 1934 spring crop. Owing to the continuous heavy rains in December little headway was made and the seed nurseries were destroyed by continued flooding. It then became evident that unless the rains ceased there would be no spring crop which eventually proved to be the case.

51. Arrangments were made to lease the Anna Regina estates from January, 1934, comprising the following sections :—

Anna Regina (two sections).
Henrietta (one section).
Richmond (two sections).
La Belle Alliance (two sections).

The Bush Lot Settlement will be retained under Government control, and also the agistment pasture at La Belle Alliance.

52. The health of the Bush Lot settlers was so bad during the year that a special committee was appointed to investigate the position with regard to health and drainage comprising Dr. E. Cochrane, G.M.O.H., Mr. R. B. Craig, District Engineer, and Mr. A. deK. Frampton, Agricultural Superintendent. It was suggested that the settlement be moved to another site, but at the time of writing no further action has been taken. Dr. Cochrane, Government Medical Officer of Health, also made a special survey of the Anna Regina estate yard and residential area.

Machinery Trials.

53. *Rice Mills.*—Extensive trials were carried out with the new rice mill plant which had been put down at Anna Regina during 1932. It was found that this plant turned out an excellent white rice at the rate of 6—7 bags per hour, but unfortunately it would not mill parboiled rice. The meal from the parboiled grain was too moist and choked the machines. Two ordinary hullers driven by a steam engine were erected for milling parboiled rice. Both white and parboiled rice have been manufactured for a Georgetown firm during the year and excellent samples were produced. Samples of white rice, glazed and unglazed, made with the new plant were shipped to the Crown Agents in England, and also to the International Grocers Exhibition, London.

54. *Power aspirating machine.*—The padi aspirating machine has again proved of great benefit to farmers during the harvesting season, the machine doing more rapid and efficient work than was possible with the old hand winnowing method, resulting in cleaner and better samples of padi being stored. It is likely that these machines may be installed on other estates in the District, as a result of the demonstrations given at Anna Regina.

55. *Threshing machine.*—Trials were again made with the power thresher, but little could be done with it due to bad weather conditions. The padi straw was water-soaked and this choked the machine. This year instead of carrying the thresher to the padi fields a new scheme was tried. The padi was cut short in the field, (as for bull mashing) and transported in cane punts to the thresher. This would seem to be a much more economical way of power threshing since to move a heavy machine several times in a day is very expensive. The only drawback is the transportation of the padi from the field to the punt, but this was done on slides drawn by oxen. Weather conditions were such, however, that the trials had to be abandoned. It is proposed to carry out further trials on these lines with the spring and autumn crops.

56. *Padi Seed drills.*—Trials were made on a neighbouring estate with a padi seed drill. Although the land was fairly high it was not sufficiently well drained and due to an excess of water much of the seed germinated badly. Weeds took over parts of the cultivation, and this eventually had to be replanted. It is hoped to make further trials under more favourable conditions.

MISCELLANEOUS.

Surveys.

57. On instructions received from His Excellency the Governor a detailed survey was carried out by the Assistant Superintendent to ascertain the amount of land

available for planting cane on the coast between Zorg and Better Hope. The result of the survey was mapped and a table showing the available areas is given below :—

TABLE SHOWING THE APPROXIMATE POTENTIAL AREAS AVAILABLE FOR SUGAR CANE CULTIVATION FROM PLANTATION ZORG TO BETTER HOPE, ESSEQUIBO.

No. of acres Cultivable Padi Lands.	Area capable of being brought under padi cultivation if proper drainage and irrigation are provided.	No. of acres under cane cultivation.	No. of acres of empoldered land available for cane cultivation.
7,054	3,396	962	5,243
No. of acres of unempoldered land suitable for cane cultivation.	No. of acres under coconuts.	No. of acres under ground provisions.	
3,664	1,522	1,107	

General.

58. His Excellency the Governor visited Anna Regina on three occasions during the year. The Director and Deputy Director of Agriculture paid several visits to the properties during the year. The Director of Public Works visited the properties in connection with the proposed removal of the Bush Lot Houses.

59. *Reports.*—The following were the most important reports submitted to the Director during the year :—

Monthly reports—Henrietta Station and Essequibo District.

Monthly reports on co-operative credit banks.

Monthly reports on school gardens.

Report of agricultural competitions.

Results of experiment carried out at the Henrietta Experiment Station.

60. In conclusion I would like to express my appreciation of the hard work put in by the staff during the year who have often worked overtime without hesitation or demur.

A. DEK. FRAMPTON,
Agricultural Superintendent,
Essequibo.

February 15, 1934.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE NORTH WESTERN DIVISION FOR THE
YEAR 1933.

CONTENTS.

				PAGE.
GENERAL	...	...	...	53
CROP CONDITIONS	...	...	...	53
Coffee ; Citrus.				
HOSORORO EXPERIMENT STATION	...	...	...	53
Coffee ; Citrus ; (Propagation Work) ; Miscellaneous (Poison Plants ; B.H. Mahogany ; Black Pepper).				
WAUNA SUB-STATION	...	...	...	56
General.				
COMPETITIONS	...	...	...	57
MISCELLANEOUS	...	...	...	57
Block Survey Schemes ; Bees ; Diseases and Pests ; Distribution of Seeds and Plants ; Reports ; Visitors ; Revenue.				

REPORT OF THE NORTH WESTERN DIVISION FOR THE YEAR, 1933.

STAFF.

E. Beckett, F.L.S.—Agricultural Superintendent.

L. E. McKinnon —Agricultural Instructor.

GENERAL.

Visits were paid to all the farms in the Aruka, Barima, Kaituma, Imbotero, Moruca, Arakaka, Mabaruma and Arukumai Hills, and various Creeks in the District. The total miles travelled by boat was 3,255.

2. The rainfall again this year was extremely heavy. The total for the year was 113 inches and 27 parts as against 111 inches and 71 parts last year. The monthly precipitation was as follows:—

January	...	7·68	July	...	12·07
February	...	6·45	August	...	13·37
March	...	1·60	September	...	8·09
April	...	2·65	October	...	9·97
May	...	15·43	November	...	10·91
June	...	14·32	December	...	10·73

CROP CONDITIONS.

Coffee.

3. There has been a very slight increase in the acreage under coffee which was returned at 2,238 acres. In some instances small farmers have planted new areas and in cases where large areas were being cultivated the grant holders reduced their areas in order to deal with the crops aided by their families and with as little hired labour as possible. The price realised for Liberian coffee was from five to six cents per pound. A shortage of labour was again experienced this year in the collection of coffee berries.

Citrus.

4. The lime factory at Mabaruma has operated satisfactorily turning out 30,000 gallons of raw lime juice and 200 gallons of essential oil of limes. The crop period was short due probably to the heavy and continuous rainfall although the crop was a heavy one.

5. The demand for budded limes continued, the majority were planted by Mr. Samson on the Mabaruma Hills.

6. During the year the following budded plants were distributed:—

Budded oranges	...	...	1,551 plants
Budded grapefruit	...	...	224 „
Budded limes	...	..	497 „
Seedling limes	...	...	268 „

Of the total number of budded oranges distributed 951 plants were sent to the Botanic Gardens to fulfil orders placed with the Department.

HOSORORO EXPERIMENT STATION.

Coffee.

7. The area of two acres of Liberian coffee retained on the pegasse flat has begun to fruit, and a small crop was reaped during the year. The remaining portion of this flat was planted with African oil palms which are making fair growth. One bed of 132 sq. rods on this flat was planted with citronella grass in February and reaped in November, the yield of dry grass obtained was 2,265 lbs. Samples of dry grass were sent to the Chemist-Ecologist for determination of oil content.

Citrus.

8. The area under budded citrus fruit was maintained, as also the area under limes. As indicated in the table given below additional varieties were added to the collection during the year.

9. The total number of plants of each class under cultivation on the lateritic hill lands at the station (exclusive of citrus nurseries) is as follows :—

Budded grapefruit including Marsh, Walters, Duncan and Foster	...	314
Budded oranges	...	122
Budded lemons	...	9
Budded limes, including Hybrid limes (St. Lucia) smooth skin and Hybrid limes (Dominica)	...	194
Succadee (Citron)	...	1
Lime seedlings	...	168

10. Sixty-one grapefruit and twenty-two orange plants fruited during the year, one of the Marsh and a Florida Marsh (seedless) produced over 200 fruits each. During 1934 more trees will come into bearing. Records of the yields of individual trees are being kept. An application of artificial fertilizer was made to some of the citrus trees for the first time during 1933; sulphate of ammonia, phosphate and potash were applied in the proportions 2:4:1. In the first planting rows 1-15 over 186 trees were treated while in the budded orange area 72 trees received similar dressings. The results of this application remain to be seen.

11. *Propagation work.*—In February a consignment of 2,000 orange budwood was received comprising Parson Brown, Valencia and Jaffa which were ordered from the St. Augustine Nursery, Trinidad. In May a further consignment of 1,000 budded oranges and grapefruit was received from the same source. In this consignment were the following varieties:—Orange (Budded):—Navel, Ruby, Homosassa, Parson Brown and Jaffa; Grapefruit (Budded):—Foster, Walters and Duncan.

12. At the end of the year the following budded citrus were on hand ready for distribution early in 1934: budded grapefruit 327; budded oranges 324; budded limes 706.

13. All the old sour orange stocks were thrown out and the nursery beds put under black eye peas as a cover crop, until the seeds sown are ready for transplanting.

14. The area under budded and grafted pears was maintained during the year; the majority of the trees produced fruits. The two trees of River produced fruits one was large and the other small and round. It has since been discovered that they are not the same, one of the trees being a "Trapp," and has been relabelled accordingly.

15. The following is a summary of permanent plants under experiment at Hosororo Station :—

BURRED GRAPEFRUIT.

Marsh	...	...	213 Plants.
Duncan	...	...	76 "
Florida Marsh	...	...	5 "
Pernambuco	...	...	2 "
Labuan	...	...	2 "
Walters	...	...	8 "
Foster	...	...	8 "
			—
			314
			—

ORANGES

St. Michael's Blood	...	...	6 Plants.
L. Summer	...	...	5 "
Jaffa	...	...	8 "
T. H. Late	...	...	9 "
Dancy Tangerine	...	...	16 "
L. G. Gong	...	...	10 "
Ruby	...	...	11 "
Parson Brown	...	...	10 "
Pineapple	...	...	9 "
Homosassa	...	...	3 "
Navel	...	...	14 "
Valencia	...	...	12 "
Satsuma	...	...	1 "
Grenada Orange	...	...	4 "
William Tangelo	...	...	1 "
Sampson Tangelo	...	...	1 "
New Tangelo	...	...	1 "
Sunrise Tangelo	...	...	1 "
			122
Ponderosa Lemon	...	...	4 "
Hybrid Lemon (Trinidad)	...	...	2 "
Hybrid Lime (Dominica)	...	...	2 "
W.I. Smooth-skinned (St. Lucia) Lime	...	...	24 "
Sicily Lemon	...	...	3 "
Succadee (Citron)	...	...	1 "

AVOCADO PEARS.

St. Anne's (Budded-Trinidad)	...	...	3 Plants.
Rivers	"	...	3 "
St. Clair	"	...	4 "
Pollock	"	...	3 "
Rudder	"	...	6 "
Munis (local grafts, Botanic Gardens)	...	...	6 "
R. C. Lord (local grafts, Botanic Gardens)	...	...	9 "
Martin-Sperry (local grafts, Botanic Gardens)	...	...	1 "
Trapp	...	...	1 "
Budded Limes	...	...	168 "
Seedlings	...	...	168 "
Old Seedlings growing in dense shade under Balata and Rubber	...	...	200 "
<i>Hydnocarpus anthelminta</i> (quite large)	...	...	3 "
<i>Hydnocarpus Venenata</i>	...	...	12 "
Nim (<i>Azardirachta indica</i>)	...	...	3 "
Black Pepper (<i>Piper nigrum</i>)	...	...	11 "
B. H. Mahogany	...	...	350 "
Citronella	...	...	$\frac{1}{2}$ acre.
Grafted Nutmegs	...	...	5 plants.
Cinnamon	...	...	3 "
Tonka beans	...	...	36 "
Insecticidal plants	...	...	5 acres.
Coffee, Liberica	...	...	2 "
Coffee (mixed varieties)	...	...	2 $\frac{1}{2}$ "

OIL PALMS.

Variety.			Plants.	
No. 391	...	...	12	} Seeds from Nigeria.
No. 480	...	...	6	
No. 69	...	...	18	
No. 321	...	...	9	
No. 306	...	...	6	
No. 332	...	...	3	}
Onderneeming (Essequibo)..	...	...	258	
Historical Cacao	...	(Rio Berbice)	...	$\frac{1}{3}$ acre.

Miscellaneous.

16. *Poison Plants*.—The experiments with plants of insecticidal value, black and white Haiari (*Lonchocarpus spp.*) have been continued.

17. E. H. Mahogany continues to make satisfactory growth, in spite of the attacks from *Hypsipyla* sp.

18. One of the black pepper (*Piper nigrum*) plants has died, but the remaining 11 plants are making satisfactory growth.

19. Twelve plants of *Hydnocarpus venenata* were planted out in May, and have made slow growth. The three *Hydnocarpus anthelminta* planted in January, 1930, are making satisfactory growth—only one of the three remaining neem plants (*Azardiracpta indica*) is making fair growth.

WAUNA SUB-STATION.

General.

20. This station was maintained during the year, and the number of acres under cultivation is 15 acres. The coconuts and oil palms planted out in June, 1932, are making satisfactory growth. The budded citrus on this station suffered from the attacks of black bees, nevertheless, they are looking green. The oranges have made better growth than the grapefruit. The budded limes have made good growth, twelve plants produced a few fruits.

With the exception of the 42 budded limes in this area, all the citrus plants received applications of artificial fertilizers. The dressings were the same as those given to the citrus plants at Hosororo. The results remain to be seen.

The black and white Haiaris planted in the open are making better growth than those planted in the shaded areas.

Seven mesquite plants—four thorny and three thornless—were planted out on August 28, and have made fair growth.

21. The following is a summary of permanent plants under experiment at this Station:—

Budded Grape Fruit—			
Marsh	...	...	87 Plants.
Budded Oranges—			
Parson Brown	...	...	32 "
Dancy Tangerine	...	...	8 "
Valencia	...	...	18 "
Navel	...	...	9 "
King Orange	...	...	5 "
William Tangelo	...	...	2 "
Sunshine do.	...	...	2 "
Sampson do.	...	...	2 "
New do	...	...	2 "

Budded Limes	...	...	42 Plants.
Succadee (Citron)	...	...	1 "
Coconuts	...	...	3½ "
Insecticidal plants	...	..	4 "
Mesquite (Thorny)	...	...	3 "
Mesquite (Thornless)	...	...	3 "
Oil Palms	...	...	3 "

COMPETITIONS.

22. The final judging of the agricultural competitions in the North West District was carried out in November. The district was divided into three :

- (a) Koriabo and Aruka districts.
- (b) Barima including Imbotero Creek.
- (c) Hill Lands.

The prizes were awarded for the best miscellaneous farm holding cultivation of not less than two acres in extent.

23. The grants were judged on the following points :—

Produce grown and general rotation	...	20 Points.
Drainage	...	20 "
Control of weeds, pests and diseases	...	20 "
Livestock	...	20 "
Coffee	...	20 "

24. A prize was also offered for the best cultivation of peas of at least two varieties.

The prizes awarded are as follows :—

KORIABO AND ARUKA DISTRICTS.

1st Prize	...	(\$15)—R. Walker.
2nd "	...	(\$10)—J. Bisnauth.
3rd "	...	(\$ 5)—J. Gomes.

BARIMA—IMBOTERO.

1st Prize	...	(\$15)—Jerome.
2nd "	...	(\$10)—C. Taylor.
3rd "	...	(\$ 5)—F. Ramit.

HILL LANDS (Hosororo Block).

1st Prize	...	(\$10)—A. Miller.
2nd "	...	(\$ 5)—R. Alfred.

MISCELLANEOUS.

Block Survey Schemes.

25. Considerable progress has been made by the farmers, good cultivations can now be seen. On the hill lands the majority have done excellent work. The budded grapefruit plants given to them are doing well. The Morawhanna scheme has proved a failure ; no effort is being made by the people to whom the lands were given.

Bees.

26. Great difficulties are being experienced here in establishing hives, owing to several enemies to them, such as wild stinging bees, some virulent type of ants, all of which tried to rob the hives of their food and even killing them out. The hives at the Hosororo Convent have produced excellent honey. Everything is being done to combat these pests.

Diseases and Pests.

27. *Sclerotium coffeicolum* (Stahel) has again made its appearance in all the districts, and in some cases was severe. In one grant in the Aruka it took hold of an area of five acres every tree being affected; farmers tried burning of all diseased materials, but the weather was much too wet to continue.

28. *Wilt Disease*.—This was very noticeable during the year, it was not only confined to the Aruka and Koriabo areas, but can be seen also in the Barima district, but not to any great extent.

Cockles.—Complaints were received that this pest is doing considerable damage. On investigation it was found that the damage is not as great as is made out by the farmers.

29. *Coushi Ants*.—These ants proved very troublesome to the small farmers who were unable to purchase carbon bisulphide to eradicate them.

School Gardens.

30. Lectures were given by the Agricultural Superintendent to the children at Hosororo R.C. School and at the Anglican School at Morawhanna. At Hosororo where there is a garden fenced around, practical lessons are given twice each week. Produce such as tomatoes, bouldangers, peppers, ochroes and peas are being grown.

Distribution of Seeds and Plants.

31. During the year the following were distributed by the Station :—

Budded grapefruit (Marsh and Duncan)	...	224 Plants.
Budded Oranges	...	1,551* „
Budded Limes	...	497 „
Lime Seedlings	...	268 „

in addition to coffee seedlings, plaintain and banana suckers, pineapple suckers cassava sticks and seeds of various peas and beans.

MISCELLANEOUS.

32. *Reports*.—The following were submitted during the year :—

Monthly progress report.
Report on Itè Palm, N.W.D.
Report on farmers' competition.
Report on *Sclerotium coffeicolum* (Stahel).
Monthly statement of accounts.
Estimates.

In official correspondence 353 communications were dealt with.

33. *Visitors*.—In addition to several farmers in the district, Government, Botanist on July 13; Colonial Auditor, July 27; H. T. King, Commissioner (Acting), November 10.

34. *Revenue*.—The amount of revenue collected for the sale of plants and produce grown at the station is two hundred and forty-three dollars and sixty-nine cents (\$243.69).

L. E. McKINNON,
Agricultural Instructor.

February 16, 1934.

* Includes 951 sent to the Botanic Gardens, Georgetown.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE PLANT BREEDER FOR THE YEAR 1933.

CONTENTS.

				PAGE.
STAFF	...	...	...	61
GENERAL	...	...	...	61
	Padi grown during 1933.			
PADI EXPERIMENTS, 1933	...	...	...	61
	Yield Trials.			
	Varietal susceptibility to "Man-rice" disease.			
	Milling Tests.			
	Variations in Growth Period.			
	Green Manuring.			
	Spacing and Manurial Experiment.			
	Nursery manuring, chelupping and field manuring.			
	Yield trials with graded seed padi.			
RICE BREEDING WORK	...	...	...	66
PURE LINE SELECTION	...	...	...	66
HYBRIDISATION	...	...	...	67
INHERITANCE STUDIES	...	...	...	67
	Inheritance of husk colour.			
	Hairiness of husk and leaf.			
	Pigmented leaf margin.			
	Summary.			
MISCELLANEOUS CROPS	...	...	...	70
CHILLIES	...	...	...	70

REPORT OF THE PLANT BREEDER FOR THE YEAR 1933.

STAFF.

L. E. W. Codd, M.Sc.—Plant Breeder.
J. Indrobeharry —Agricultural Assistant.

GENERAL.

1. Supervision of the Central Rice Experiment Station, Georgetown, was continued, and during the absence of Messrs. Peterkin and Gillespie on leave, charge was taken of the pure line padi work in the East and West Demerara Districts.

2. A visit was paid to the B.G. Fruit and Canning Company's pineapple cultivation at Dalgin in connection with the laying down of a manurial trial.

3. *Padi Grown during 1933.*—Pure line padi grown on the Experiment Station is handed over to the Agricultural Superintendent, East Demerara, for storage and distribution. A record of padi grown is shown below in Table I. :—

TABLE I.
PADI GROWN DURING 1933.

Variety.	Spring Crop lbs.	Autumn Crop lbs.	Total lbs.
Demerara Creole	3,683	26,505	30,188
No. 79	3,102	27,600	30,702
H 7	...	1,168	1,168
Blue Stick	...	1,321	1,321
Kalyaman	...	2,018	2,018
Ramajara	...	1,146	1,146
Hybrids and Progeny Rows	...	3,015	3,015
Total	6,785	62,773	69,558

The area under rice at the Experiment Station is approximately 20 acres, so the yield during the autumn crop corresponds to about 22.5 bags of 140 lbs. padi per acre.

PADI EXPERIMENTS, 1933.

Yield Trials.

4. Two variety trials were conducted in Demerara during 1933, one at the Experiment Station, Georgetown, and one at La Jalousie, West Coast, Demerara. Mean yields obtained are summarised below in Table III. :—

TABLE III.
VARIETY TRIALS CONDUCTED DURING 1933.

Situation.	Georgetown.		La Jalousie.	
Layout.	Three 6 x 6 Latin Squares.		Two 6 x 6 Latin Squares.	
Variety.	Padi Lbs. per acre.	Order of Merit.	Padi Lbs. per acre.	Order of Merit.
No. 79	3,186	1	4,048	1
Blue Stick	3,162	2	3,704	2
H 7	2,935	3	3,392	6
Demerara Creole	2,786	4	3,456	5
Kalyaman	2,769	5	3,696	4
Ramajara	2,578	6	3,704	2
Significant Difference (P=0.05)	126	...	197	...

5. It will be seen that the variety No. 79 heads the list in both trials. It was significantly better than all other varieties in the La Jalousie trial, and all other varieties except *Blue Stick* in the Georgetown trials.

6. *Demerara Creole* and *H 7* were more successful in East than in West Demerara.

7. *Ramcajara* gave a fairly good yield at La Jalousie, but was significantly lower than all other varieties in the Georgetown trial.

Varietal Susceptibility to "Man-rice" Disease.

8. During the course of the Georgetown trial, data were collected on varietal susceptibility to the disease known as "man-rice." This disease presents a striking appearance in the field, as the affected tillers shoot up above the healthy plants, turn pale green and then die off. It is doubtful, however, if the disease is ever responsible for serious loss, because the actual incidence is never very high, and fresh shoots usually spring up in place of the diseased ones. Actual counts show a distinct varietal differentiation in susceptibility to this disease as will be seen from Table IV. below :—

TABLE IV.
SHOWING DATA ON "MAN-RICE" DISEASE.

Variety.	Mean No. "Man-rice" Plants per plot of 1/80th acre.
No. 79	0.6
Demerara Creole	3.5
Blue Stick	5.2
H 7	6.2
Kalyaman	7.0
Ramcajara	9.2
Significant Difference	1.5

Milling Tests.

9. A bag of each of the six varieties of padi was milled and submitted to the Rice Grading Office for an analysis for broken and discoloured grains. The results obtained are listed below in Table V. :—

TABLE V.
PADI MILLING TEST.

Variety.	Grain Type.	Per Cent. Broken and Discoloured Grains.	Grade.
Blue Stick	Medium length	9.9	Super
No. 79	do.	11.3	Super
Demerara Creole	Long, fine	18.8	No. 1
Ramcajara	Medium, coarse	20.2	No. 1
H 7	Long, fine	24.6	No. 1
Kalyaman	do.	30.3	No. 2

This table supports the results of previous tests, namely, that the long grained varieties produce lower quality rice than the medium length types.

Variations in Growth Period.

10. It is the common experience of farmers that the growth period of padi varies with the date of sowing the seed. The degree of variation in the variety *Demerara Creole* is shown below in Table VI. :—

TABLE VI.
VARIATIONS IN THE GROWTH PERIOD OF *DEMERARA CREOLE*,

Date of Sowing.	Date of Flowering.	No. of days. sowing—flowering.
22.3.33	2.8.33	133
3.4.33	11.8.33	130
8.4.33	9.8.33	123
18.4.33	15.8.33	119
17.5.33	2.9.33	108

Green Manuring.

11. An experiment was conducted to estimate the value of incorporating green material in the soil before transplanting. The green material used was a species of *Vigna* which was established by cuttings in a rice bed, where it made quite a satisfactory cover. An analysis of this material supplied by the Chemist-Ecologist was as follows:—

Carbon	...	...	35.5%
Nitrogen	...	...	3.2%
Carbon : Nitrogen ratio	...	...	11.1
Ash	...	...	8.4%

12. The green manure was transported to the plots and puddled in five days before transplanting. The yields obtained are shown below in Table VII. :—

TABLE VII.

GREEN MANURING TRIAL.

Treatment.				Padi. lbs. per acre.	Percentage of Mean.
5 tons green manure per acre	...	...	...	3,230	102.4
2 tons green manure per acre	...	...	...	3,234	101.0
No manure	...	...	...	3,094	96.6
Significant Difference (P=0.05)				223	7.0

13. Although the manured plots gave a higher yield than the control, the increase was not significant.

Spacing and Manurial Experiment.

14. A combined manurial and spacing experiment included the following manurial treatments:—

- (a) No manure—control.
- (b) Sulphate of Ammonia—2 cwt. per acre.
- (c) Superphosphate—3 cwt. per acre.
- (d) Sulphate of Ammonia—2 cwt. per acre and Superphosphate—3 cwt. per acre.

These treatments were repeated at 5 x 5, 8 x 8 and 11 x 11 inch spacing.

15. The experiment was put down in 10 randomised blocks, and the mean yields obtained, expressed in lbs. padi per acre, are shown below in Table VIII. :—

TABLE VIII.

SPACING AND MANURIAL TRIAL.

				5 x 5 inch.	8 x 8 inch.	11 x 11 inch.	Means for Manures.
Sulphate of Ammonia	Phosphate	...	...	3,028	2,996	2,792	2,939
	No. Phosphate	...	...	3,088	2,808	2,612	2,836
No. Sulphate of Ammonia	Phosphate	...	...	3,044	2,591	2,408	2,681
	No. Phosphate	...	...	2,376	2,436	2,113	2,308
Means for Spacing				2,384	2,708	2,481	2,691

Significant difference 270 lbs. per acre.

16. Sulphate of ammonia and superphosphate give significant increases applied singly and in combination, but phosphate gives no increase in the presence of nitrogen.

17. 5 x 5 inch spacing proved the most successful in this experiment, though it will be seen that 8 x 8 inch spacing was the best for non-manured plots.

18. The highest yield obtained was at close spacing with an application of sulphate of ammonia and amounted to 3,088 lbs. per acre. Even this increase, however, was not remunerative.

Nursery Manuring, Chelupping and Field Manuring.

19. In this experiment the following treatments were employed:—

- (1) No manure—control.
- (2) Nursery manuring at the rate of 200 lbs. Niciphos B. per acre of seed-bed, applied at the time of sowing.
- (3) As in (2) but with an additional dressing of 200 lbs. Niciphos B. applied two weeks after the seed was sown.
- (4) Chelupping—the roots of the seedlings were dipped in a paste of bone-meal at the time of transplanting. The amount of bone-meal used in this way was about 150 lbs. per acre.
- (5) Field manuring—200 lbs. Niciphos B. per acre applied to the field at the time of transplanting.

20. Three nurseries were made up and seed of the variety *No. 79* was sown on June 14. Niciphos was applied to two of the nurseries (treatments 3 and 4) on the same day. A further dressing of Niciphos was given to one of these nurseries (treatment 4) on June 28. The seedlings were transplanted into two 5 x 5 Latin Squares on July 12.

21. The mean yields obtained are shown below in Table IX. :—

TABLE IX.

Treatment.	Yield of Padi.	
	lbs. per acre.	Percentage of Mean.
Chelupping	2,928	106.3
Field manuring... ..	2,920	106.0
Nursery manuring—one dressing	2,720	98.8
Control—no manure	2,680	97.6
Nursery manuring—two dressings	2,520	91.5
Significant Difference ($P=0.05$)	226	8.2

22. Both chelupping and field manuring gave significant increases of nearly two bags of padi per acre, but in neither case does this increase cover the cost of the fertilisers. A single dressing of Niciphos applied to the nursery has no effect on the yield, while a double dressing depresses it, though the decrease is not significant. This loss in yield is due no doubt to the production of an excessive amount of leaf in the early stages.

Yield Trials with Graded Seed Padi.

23. The trial carried out in 1932 with *Demerara Creole* seed graded by the seed selecting machine indicated that no benefit accrued from the sowing of large seed in preference to unseparated seed. Further trials with *Demerara Creole* and *No. 79* laid down in 1932 and reaped early in 1933 are shown below in Table X. :—

TABLE X.

YIELD TRIALS WITH GRADED SEED PADI.

Variety.	Demerara Creole.	No. 79.
Layout of Experiment.	Three 4 x 4 Latin Squares.	Four 3 x 3 Latin Squares.
Grade of Seed.	Mean yield of Padi. Lbs. per per acre.	
A. Large	2,900	2,283
B. Medium	2,850	...
C. Small	2,883	2,223
D. Unseparated	2,857	2,177
Significant Difference ($P=0.05$)	148	132

It will be noted that no significant differences in yield were observed between the various grades of seed.

24. It was considered possible that continued mass selection of this nature might eventually separate the variety *Demerara Creole* into two strains of inherently different grain size. The padi obtained from the A, B, C and D plots was therefore bagged off separately, and a bag of A padi and a bag of C padi were put through the seed selecting machine. The padi was graded by the machine in the following proportions :—

Grade.	Percentage separation of Padi.			Total.
	Large.	Medium.	Small.	
'A' padi	11.3	67.3	21.4	100
'C' padi	6.4	66.7	26.9	100

It will be seen that there is a greater percentage of large seed in the 'A' padi and a greater percentage of small seed in the 'C' padi, suggesting that there has actually been a rough separation into inherently different strains.

25. The large, medium and small seed from the 'A' padi, and the small seed from the 'C' padi were reserved for the following experiment which was sown on June 26. The mean yields observed are shown in Table XI. :—

TABLE XI.
YIELD TRIAL WITH GRADED DEMERARA CREOLE SEED.

Grade.	Description.	Padi Lbs. per acre.
A 1	Large seed from 'A' padi	2,452
A 2	Medium seed from 'A' padi	2,596
A 3	Small seed from 'A' padi	2,476
C 3	Small seed from 'C' padi	2,568
D	Unseparated seed from previous control plots	2,540
Significant Difference (P=0.05)		192

No significant differences in yield were observed in this trial.

26. The padi yielded by the various grades of seed was bagged off separately, and two bags of each grade of padi were again put through the seed-selecting machine. The mean separations observed were ;—

Grade of Seed.	Percentage separation of Seed.			Total.
	Large.	Medium.	Small.	
A 1	36.2	48.2	15.6	100
A 2	37.8	47.5	14.7	100
A 3	28.8	53.7	17.5	100
C 3	28.6	54.2	18.2	100
D	31.1	52.1	16.8	100
Mean of A1, A2, A3 and C3...	32.8	50.7	16.5	100

27. This table brings out the following striking results :—

(1) A1 and A2 padi contain a higher percentage of large seed and a lower percentage of small seed than A3 and C3 padi.

(2) The composition of A3 and C3 padi is almost identical.

(3) If the mean of A1, A2, A3 and C3 padi is taken, it is found to be very similar to the unseparated padi (D); i.e., if we mixed all the separated grades together we should get a mixture very similar to the original *Demerara Creole* sample.

(4) Comparing this experiment with the previous one (which was conducted during the spring crop, it will be seen that there was a greater proportion of large seeds in these samples of padi than in the previous samples. This suggests that the padi grown during the autumn crop is on the whole larger than the padi grown during the spring crop.

(5) The fact that the composition of the A3 padi was a good deal different from that of the A1 and A2 padi indicates that the selection has not yet resulted in the isolation of pure lines. It is probable, however, that the bulk of the A1 and A2 padi is genetically different from the bulk of the C3 padi.

28. This selection along two divergent lines is being continued, and a further experiment has been laid down for the spring crop. The grades to be tested in this experiment are:—

- A1 No. 1—Large seed from the A1 padi.
- A1 No. 2—Medium seed from the A1 padi.
- A1 No. 3—Small seed from the A1 padi.
- C3 No. 3—Small seed from C3 padi.
- D —Unseparated seed from previous control plots.

This type of mass selection will be continued until the three grades of 'A' padi show the same composition on being put through the grading machine. When this stage is reached, it is obvious that there will be no point in selecting further for size of seed.

RICE BREEDING WORK.

Pure Line Selection.

29. One hundred and sixteen single plant selections from 55 varieties were grown in observation plots of approximately 300 plants. The first ten varieties in order of yield were as follows:—*Ak Kulu*, *McKenzie Small*, No. 78, No. 79, H. 6, *Lead Rice*, *Demerara Creole*, *Blue Stick*, *Kristnakatakulu* and H 7. These varieties, together with *Ramcajara* and *Kalyaman*, have been reserved for competitive trials in 1934. The first two varieties have yielded consistently well in the Progeny Rows over the last three years, but they possess grain of the "barley" type which is not in great demand locally.

30. Several of the poor yielding and late varieties have been discarded to make room for recent importations.

31. Twenty-three new varieties were received during 1933, as shown below. Germination was fair to good in all cases and these types have been planted up in observation plots:—

Country of Origin.	No. of Varieties.	Date received.
Surinam	1	28. 6.33
Louisiana, U.S.A.	1	18. 7.33
Fiji Islands	2	1.10.33
Mandalay, India	6	17.10.33
Sind, India	4	27.10.33
New South Wales	2	4.11.33
Punjab, India	7	7.11.33
Total	23	...

32. During the course of tours of inspection in the districts 22 new types were collected from peasant holdings. These new varieties have been sown along with the existing collection and will be planted out in observation plots early in 1934.

Hybridisation.

33. Two generations of hybrids were grown again this year and the following table shows the number of selections kept under observation :—

Nature of Cross.	Autumn Crop.	Spring Crop.
Americano 1600 x Demerara Creole ...	83 F ₄	81 F ₅
Mexican Edith x Demerara Creole ...	59 F ₄	52 F ₅
A 16.34 x H 7 ...	34 F ₄	Discarded
Garikasannavari x No. 79 ...	27 F ₃	30 F ₄
Kristnakatakulu x Carolina Edith ...	...	50 F ₃
Kristnakatakulu x No. 79 ...	...	24 F ₃

34. It was hoped that some valuable types might be evolved from the cross between *Carolina Edith* and *Kristnakatakulu*, but, owing to the great diversity between the two parents and the consequently large number of characters involved, scarcely any plants of the desired type were found out of several thousand F₂ individuals. 50 selections were made from the F₂, but the majority of F₃ plots grown from these selections showed as wide a range of segregation as the F₂ generation.

35. Selections from the first two crosses are approaching homozygosity and should be ready for trial during the forthcoming season.

Inheritance Studies.

36. A great deal of variation is found in the colour of the husk (lemma and palea) which encloses the grain and several crosses were made in order to study the inheritance of these colour characters. The opportunity was taken to study other characters also, and a list is given below of the parents employed and the characters under observation.

Loomee : This variety possesses a short thick grain, usually awned. The husk is green with black furrows at the flowering stage and ripens to a light brown colour with dark brown furrows. The upper surface of the leaf is rough, and the husk is covered with long hairs. There is no anthocyanic pigment.

Rupununi : Grain medium long and very broad. The husk is yellow-green at the flowering stage and ripens to a golden colour. The internode is also golden and it has been shown ⁽¹⁾ that these two characters are always inherited together. The leaf and husk are perfectly smooth. The branches of the inflorescence are distinctly curved, giving the inflorescence a wavy appearance. There is no expression of anthocyanic pigment, though the presence of factors for the production of pigment in the axil of the leaf sheath and stigma has been demonstrated ⁽²⁾.

No. 11 : Grain short and coarse. The husk is green with gold furrows at the flowering stage and ripens to a dark golden colour. The leaf and husk are covered with rough hair. There is no anthocyanic pigment.

Ramcajara : Grain medium length, fairly coarse. The husk is straw colour with patches of purple pigment. This anthocyanic pigment also occurs in the outer glumes, internode, leaf sheath and leaf margin. The branches of the inflorescence are straight, and the husk and leaf are covered with short hairs.

37. It should be noted that the purple colour of the husk in *Ramcajara* is due to anthocyanic pigment, and is dominant to the normal straw colour. The other husk colours are non-anthocyanic in origin and are recessive to the normal straw colour.

38. *Inheritance of Husk Colour* : The mode of inheritance in some of the cases quoted below is rather obscure and requires corroborative evidence, which is not yet available, from the F₃ generations.

⁽¹⁾ Divisional Reports of the Department of Agriculture, British Guiana, 1932.

⁽²⁾ Ibid.

39. *Ripening Gold* x *Black Furrows*.—This study was made in the cross between *Rupununi* and *Loomee*. In the F_1 the husk was green at the flowering stage and ripened to normal straw colour. If these two colour factors are independent, a ratio of 9 straw : 3 black furrows : 3 ripening gold : 1 ripening gold black furrows would be expected in the F_2 . The actual figures observed are shown below:—

		Straw.	Black furrows.	Ripening gold.	Ripening gold Black furrows.
Observed figures	...	98	49	47	9
Expected 9 : 3 : 3 : 1	...	114.3	38	38	12.7
Deviation from expectation	...	-16.3	+11.0	+9.0	-3.7

The excess of individuals in the classes "Black Furrows" and "Ripening Gold" suggests that there is an association between these two colour characters.

40. *Gold Furrows* x *Ripening Gold*.—This is the cross between *No. 11* and *Rupununi*. In the F_1 , the husk was green at the flowering stage and ripened to normal straw colour. The F_2 segregation was obscure.

41. *Black Furrows* x *Purple*.—This study was made in the cross between *Loomee* and *Ramcajara*. In the F_1 the husk resembled *Ramcajara*, i.e., straw colour with purple patches. The purple pigment is produced by two complementary factors giving a 9.7 ratio, while the black furrows are produced by a single factor recessive to the straw colour. If all these factors are independent, one would expect a 27 : 21 : 9 : 7 ratio in the F_2 , and an inspection of the following table shows a close agreement between observed and calculated figures:—

		Purple.	Straw.	Purple Black furrows.	Black furrows.
Observed figures	...	39	24	17	9
Calculated 27 : 21 : 9 : 7	...	38	29	12	10

42. *Ripening Gold* x *Purple*.—These characters were studied in the cross between *Rupununi* and *Ramcajara*. In the F_1 the husk ripened to normal straw colour with a tinge of purple. This suggests the presence of an inhibitor affecting the expression of purple colour, because, in all other crosses with *Ramcajara*, the husk has always been as deeply pigmented in the F_1 as in the parent. The F_2 figures give clear indication of an inhibiting factor which is not always strong enough, however, to suppress completely the purple pigment. (An example of this was seen in the F_1).

43. A single factor difference for purple colour would produce a ratio of 3 purple : 1 straw in the F_2 , and in the presence of a complete inhibitor the ratio would become 13 straw : 3 purple. The figures observed in the F_2 were 263 straw and 133 purple, which do not approach a 13 : 3 ratio. However, the deviation is without doubt due to the fact that the inhibitor is not powerful in its action. Ripening gold and straw colour segregated into a very close 3 : 1 ratio, the observed figures being 300 straw : 96 ripening gold, while the expected figures were 298 : 98. The relationship between the factors for purple pigment and ripening gold cannot be concluded, however, without F_3 data.

44. *Hairiness of husk and leaf*.—In most varieties of rice the upper surface of the leaf blade and the outer surface of the husk are covered with short hairs, not always clearly visible to the naked eye, but very obvious to the touch. In some varieties the husk hairs are longer and easily discernible while the leaf, hairs remain constant; occasionally, there are no hairs on husk or leaf, making them perfectly smooth to the touch. One variety was observed in which the husk hairs were absent,

but the leaf was sparsely covered with longish hairs, giving it a downy or silky appearance. In all the varieties which have come under observation the leaf margin is serrated and this appears to be a non-variable character.

45. The inheritance of hairiness was studied in crosses between *Rupununi* (smooth leaf and husk) and *Rameajara*, *Loomee* and *No. 11* (hairy leaf and husk). Hairiness was dominant in each case and the F_2 segregations are shown in the table below. The figures in brackets have been calculated on the basis of an expected 3.1 ratio in each case:—

HAIRY VS. SMOOTH LEAF AND HUSK.
 F_2 SEGRAGATIONS.

Nature of Cross.	Rough leaf and husk.	Smooth leaf and husk.	Total.
Rupununi x Rameajara	316 (315)	104 (105)	420
Loomee x Rupununi	214 (222)	82 (74)	296
No. 11d Rupununi	279 (276)	90 (92)	369

It will be seen that the observed figures agree very closely with the expected monofactorial ratio. Hairiness of the husk was always associated with hairiness of the leaf—not one exception was encountered in 1,085 F_2 plants—so it appears that these two characters are produced by a single factor.

46. *Pigmented leaf margin.*—In *Rameajara*, the margin of the leaf blade is coloured purple with anthocyanic pigment, while in *Rupununi* it is green. In the F_1 of the cross between these two varieties the leaf margin was pigmented and the F_2 segregated into 308 plants with purple margin and 112 plants with green margin—a very close approximation to a 3 : 1 ratio.

47. The association between pigmented margin and roughness of the leaf is shown below:—

	Rough leaf.	Smooth leaf.	Segregation of roughness (3:1).
Purple leaf margin	257 (236)	71 (79)	308 (315)
Green leaf margin	79 (79)	33 (26)	112 (105)
Segregation for margin colour (3 : 1)	316 (315)	104 (105)	...

The figures in brackets have been calculated on the assumption that the two characters are independent, giving a 9 : 3 : 3 : 1 ratio.

48. *Summary.*—The following table is a summary of the inheritance studies discussed above:—

Characters studied.	F_1	F_2 segregation.
Black furrows x Ripening gold husk	... Straw coloured	... Approximately 9 straw: 3 black furrows: 3 ripening gold: 1 black furrow ripening gold.
Gold furrows x Ripening gold husk	... Straw coloured	... Obscure.
Black furrows x Purple husk	... Purple	... 27 purple: 21 straw: 9 purple black furrows: 7 black furrows.
Ripening gold x Purple husk	... Straw, tinged with purple	... Rather obscure owing to a factor restricting the expression of the purple factor.
Rough x Smooth leaf and husk	... Rough	... 3 rough: 1 smooth.
Purple x Green leaf margin	... Purple	... 3 purple: 1 green.

MISCELLANEOUS CROPS.

Chillies.

49. A number of chilli varieties have been imported since the end of 1932 with a view to obtaining a type suitable for curing and exporting. A list is given below of the varieties received to date :—

Variety.	Date Received.	Origin.	Remarks.
Guntur No. 1	5. 8.32	Madras	Fairly pungent.
Guntur No. 2	"	"	do.
Shatta	16. 8.32	Palestine	"Bird-pepper."
Tanjore	3.10.32	Madras	"Sweet-pepper."
Coimbatore Long	"	"	Not pungent.
Coimbatore Round	"	"	do.
Godavari Red	"	"	do.
Godavari Yellow	"	"	do.
Tinnevelly	"	"	Fairly pungent.
Keppitiyawa	19. 5.33	Ceylon	Destroyed by floods.
Tuticorin A	"	"	Failed to germinate.
Tuticorin B	"	"	do.
Jaffna No. 12	"	"	do.
Canadian	4. 8.33	Canada	Seed obtained from cured specimen. Fairly pungent.

These varieties have been grown in observation plots at Sub-station Cecilia and selections made to keep the varieties pure.

50. The most promising types are the two Guntur varieties and Tinnevelly—particularly the latter. The Canadian variety is probably the best type for curing, but the yield is rather poor. A large block of the Tinnevelly variety is at present under cultivation from which it is hoped to make a trial shipment of cured peppers.

L. E. CODD,
Plant Breeder.

March 15, 1934.

DEPARTMENT OF AGRICULTURE.

REPORT ON THE SUGAR EXPERIMENT STATIONS FOR THE
YEAR 1933.

CONTENTS.

STAFF	...	...	...	PAGE.
				73
GENERAL	...	...	...	73
	Committee ; Finance ; Equipment.			
CANE BREEDING AND INTRODUCTION		...	...	74
EXPERIMENTATION	...	...	...	76
	Experiments Reaped—(Variety trials ; Manurial trials ; Drainage trials ; Spacing trials) ; Experiments in progress.			
MISCELLANEOUS	...	...	...	79
	Cane Sold ; Soil Samples ; Cane Samples ; Plant Distribution ; Root Samples ; Rice from Flood-Fallowed Land ; Monthly Reports ; Visits ; Rainfall.			

REPORT ON THE SUGAR EXPERIMENT STATIONS FOR THE YEAR 1933.

STAFF.

C. H. B. Williams, A.I.C.T.A., Dip. Agr.	—Cane Agronomist.
C. Cameron	—Field Manager.
J. Singh, Dip. Agr.	—Field Assistant.
L. A. Forte	—Field Assistant.
B. A. MacArthur	—Field Assistant.
H. R. Wren	—Field Assistant.
L. A. Robinson	—Laboratory Assistant.
H. B. Singh	—Laboratory Assistant.
E. F. L. Backer	—Laboratory Assistant.
J. M. Smith	—Laboratory Assistant.
J. B. Bourne	—Clerical Assistant.

Mr. C. Cameron resumed duty on March 27, after 6 months study leave spent at the Imperial College of Tropical Agriculture, Trinidad.

2. Mr. J. B. Bourne was absent on sick leave from January 24 to March 6, while Mr. L. A. Robinson was on vacation leave from January 9 to 30.

3. Mr. J. Singh relinquished his post at the end of July to accept a position with the Venezuelan Government, and Mr. E. F. L. Backer resigned at the end of November to join the staff of Messrs. Geddes Grant, Ltd. No appointments have been made to these posts.

4. Mr. C. H. B. Williams left the Colony on August 29, on 10 months study leave which is being spent in the Graduate School of Biology of Harvard University.

GENERAL.

Committee.

5. The Sugar Experiment Stations' Committee for 1933 comprised :—

The Hon. The Director of Agriculture	—Chairman.
The Hon. G. E. Anderson	—Pln. Diamond.
The Hon. M. B. G. Austin	—Messrs. Curtis Campbell & Co., Ltd.
Mr. J. C. Gibson	—Pln. Port Mourant.
Mr. James Bee	—Pln. Albion.
Mr. A. Murison	—Pln. Uitvlugt.
Mr. C. Farrar	—Messrs. S. Davson & Co., Ltd.
Mr. C. L. C. Bourne	—Secretary to the Committee.

6. The Honourables G. E. Anderson and M. B. G. Austin, and Messrs. J. C. Gibson and C. Farrar were absent on leave from the Colony for six months during the year and the following gentlemen were appointed to act: Messrs. R. E. Rhodes, H. G. Seaford, W. Richards and G. M. Eccles, respectively.

Finance.

7. The amount voted from the funds of the Sugar Experiment Stations' Committee for 1933 was \$18,300, and the amount actually spent was \$18,209.79. The revenue from sale of canes exceeded the estimate by \$1,135.68, while other sales, etc., yielded \$141.30.

8. A grant of \$4,358.49 was made from Imperial Funds to assist in the maintenance of the research work. Of this, \$3,280.98 was contributed by the Empire Marketing Board and \$1,077.51 by the Colonial Development Fund. The major portion of these funds was expended in improving drainage, etc., at the Station, and in the initiation of new variety trials. Without this financial assistance much of the experimental work done could not have been attempted.

9. As was mentioned in the Report for 1932, a joint contribution was made to the Station's funds by Messrs. Barker Bros., McConnell & Co., Ltd., and Imperial Chemical Industries. This enabled the Station to undertake additional experimentation with manures. A total of £1,330.27 was spent under this head.

Equipment.

10. An aqueduct connecting the East and West navigation trenches was laid across the Side Line dam. This economically facilitates the transportation of tops, manures, etc., between the two sections.

11. In preparation for the greater number of seedlings that were bred this year, the jalousie roof of the older nursery house, which had failed to serve its purpose, was replaced by a glass one.

CANE BREEDING AND INTRODUCTION.

12. At the end of the year there were 164 Demerara seedlings in replicated field tests. The following table shows their distribution as to the year in which they were bred :—

TABLE I.

SEEDLINGS IN REPLICATED FIELD TESTS.

Year bred.	No. of Seedlings.
1902	1
1912	1
1913	3
1917	7
1918	7
1920	17
1921	21
1922	14
1923	1
1924	1
1927	4
1928	15
1929	2
1930	70
Total	164

13. In addition to the above, there were 160 other seedlings undergoing multiplication and preliminary selection. Their distribution as to the year of breeding was as follows :—

TABLE II.

SEEDLINGS UNDERGOING MULTIPLICATION AND SELECTION.

Year bred.	No. of Seedlings.
1920	3
1921	10
1922	14
1923	1
1927	19
1928	19
1929	20
1930	56
1931	4
1932	14
Total	160

14. It will be seen that there is a considerable increase in the number of canes under experimentation and that the 1930 seedlings have reached the experimental stage. The field trials have shown, however, that a large number of the older varieties can be eliminated and they will be dropped from future trials.

15. The standard cane of the Colony, D 625, is used in all the tests, except at Pln. Diamond, where Diamond 10 is the accepted standard, and, in addition, the following introduced canes are also being experimented with :

G. 119	S. W. 3	Berbice	B. H. 10 (12)	S. C. 12 (4)
P.O.J. 213	P.O.J. 253	P.O.J. 1499	P.O.J. 2714	P.O.J. 2727
P.O.J. 2753	P.O.J. 2878	Co. 210	Co. 213	Co. 281

16. With the rapid accumulation of data from the variety trials it is now becoming more evident which are the strains and varieties possessing and transmitting the characters required in a successful cane under local conditions. Since no one strain carries all these characters, the general trend of the breeding work is to try to combine as many of them as possible in a single individual.

17. The following is a list of the crosses attempted in 1933 :—

TABLE III.
CANE CROSSES MADE IN 1933.

Par-nts.				Heads.	Boxes sown.	Germination.
Female.		Male.				
P.O.J. 2578	x	Diamond 10	...	21	25	Low.
"	x	D. 625	...	5	8	"
Co. 281	x	Diamond 10	...	9	9	"
Co. 210	x	"	...	4	2	"
S. C. 12 (4)	x	"	...	8	17	High.
G. 312	x	"	...	2	2	Very fair.
B. H. 10 (12)	x	"	...	5	5	Low.
Berbice	x	"	...	3	9	High.
C. Roxa	x	"	...	1	3	Low.
S. W. 3	x	"	...	3	3	Fair.
M. P. R. 42	x	"	...	4	3	Low.
" " " 145	x	"	...	3	6	"
" " " 44	x	"	...	3	5	"
" " " 808	x	"	...	1	3	"
T. 1186	x	"	...	3	12	"
Diamond 10	x	D. 625	...	11	10	High.
"	x	S. W. 3	...	2	2	Fair.
"	x	B. H. 10 (12)	...	5	3	High.
"	x	Co. 281	...	5	3	"
D. 625	x	Diamond 10	...	6	6	"
D. 602/22	x	"	...	12	14	Low.
D. 604/18	x	"	...	8	20	Fair.
D. 66/30	x	D. 625	...	2	6	High.
D. 66/30	x	D. 63/27	...	1	3	Poor.
D. 814/12	x	Diamond 10	...	7	10	Low.
D. 53/27	x	"	...	5	11	Fair.
D. 438/21	x	"	...	5	11	Fair to low.
D. 219/30	x	"	...	4	7	Low.
D. 684/21	x	"	...	7	12	Fair.
"	x	D. 602/22	...	4	4	Low.
D. 75/28	x	Diamond 10	...	2	1	High.
D. 26/0	x	"	...	4	3	Fair.
D. 1159/22	x	"	...	8	6	"
D. 895/22	x	"	...	5	4	"
D. 628/21	x	"	...	7	5	"
D. 78/27	x	"	...	5	4	Low.
D. 11/28	x	"	...	6	4	Very low.
D. 88/30	x	"	...	4	5	Good.

18. Unfortunately, certain other varieties selected for crossing did not flower ; in consequence they had to be left out of the programme.

19. In view of the possibility of eventually obtaining a very early maturing variety, i.e., a short crop cane, an attempt was made to cross Sorghum with sugar cane. It will be seen from the next table that 100 seedlings were obtained.

TABLE IV.
CANE x SORGHUM CROSSES MADE IN 1933.

Parents.		Heads.	Number of seeds germinated.
Female.	Male.		
P.O.J. 2725	x Sorghum ...	2	14
P.O.J. 2878	x " ...	2	33
D. 1.23	x " ...	2	53
Total		6	100

20. No cane introductions were made during the year.

EXPERIMENTATION.

Experiments Reaped.

21. *Variety Trials*.—Thirty-one variety trials were reaped during the year. The results of six trials, reaped during the first half of the year, appeared in *Sugar Bulletin* No. II. The results of the remaining twenty-five trials will appear in *Sugar Bulletin* No. III. It suffices to state here that the trials conducted to date indicate that the varieties Diamond 10 and P.O.J. 2878 are likely to outyield the standard cane in most instances and their extension is recommended. Certain other varieties are maintaining their early promise but it is necessary to accumulate further data concerning them.

22. *Manurial trials*.—Twelve manurial trials were reaped during the year. The results of seven of these appeared in *Sugar Bulletin* No. II. The results of the remaining five will be reported in *Sugar Bulletin* No. III. The general indications of the results to date are :—

- (1) On unflooded frontland soils and on ratoons on flooded land, doses of sulphate of ammonia, as high as 4 cwt. per acre may prove economically sound ;
- (2) On flooded frontland soil, doses of more than 2 cwt. sulphate of ammonia per acre are not likely to prove economical on plant canes ;
- (3) On unflooded pegasse it might be advantageous to apply as much as 6 cwt. sulphate of ammonia per acre to plant canes ;
- (4) On unflooded clay at Sophia, neither phosphate nor potash had any effect on yields of cane or sucrose ;
- (5) On unflooded pegasse at Diamond, 2 cwt. sulphate of potash produced increases in yield ;
- (6) Heavy doses of limestone may reduce purity, while heavy doses of nitrogen as sulphate of ammonia often reduce purity and sucrose content and cause a rise in glucose ratio, an effect which may sometimes be neutralised by applications of ground limestone or sulphate of potash ;
- (7) No definite response has been obtained from the application of lime-bearing materials to flooded clay.

23. *Drainage trials*.—Two drainage trials with second ratoons were reaped in Field 9 W., Sophia. Statistical analysis of the results disclosed that there was no significant effect from the various treatments.

24. *Spacing trials*.—Two spacing experiments were reaped. The results obtained from Field 3 E., Sophia, have appeared in *Sugar Bulletin* No. II. Field 14 E., Sophia, was reaped as first ratoons, and the results will appear in *Sugar Bulletin* No. III.

Experiments in Progress.

25. The following table lists the various experiments in progress, their location, layout, etc. :—

TABLE V.
EXPERIMENTS IN PROGRESS, 1933.

Estate.	Field.	Kind of Experiment.	Number of		Age of Cycle.	Date Started or Reaped.	Layout.
			Treatments.	Replicates.			
Sophia	1 E.	Variety	8	8	1st Ratoons	5. 9.33	Lat. Square.
"	13 E. (1)	"	7	5	Plants	1. 6.33	Ran. Blocks.
"	13 E. (2)	"	7	5	"	1. 6.33	" "
"	13 E. (3)	"	7	5	"	1. 6.33	" "
"	13 E. (4)	"	7	5	"	1. 6.33	" "
"	16 E. (1)	"	7	5	"	24. 5.33	" "
"	16 E. (2)	"	7	5	"	24. 5.33	" "
"	16 E. (3)	"	7	5	"	24. 5.33	" "
"	16 E. (4)	"	7	5	"	24. 5.33	" "
"	11 E. (1)	"	7	5	"	23. 6.33	" "
"	11 E. (2)	"	7	5	"	23. 6.33	" "
"	11 E. (3)	"	7	5	"	23. 6.33	" "
"	11 E. (4)	"	7	5	"	23. 6.33	" "
"	3 E.	"	6	6	1st Ratoons	6. 3.33	Lat. Square.
"	4 E.	"	9	7	2nd Ratoons	30.11.33	Ran. Blocks.
"	5 E.	"	8	7	"	12. 9.33	" "
"	6 E.	"	5	7	"	14. 9.33	" "
"	14 E.	"	6	6	"	23.11.33	Lat. Square.
"	8 E.	"	10	7	"	24. 4.33	Ran. Blocks.
"	9 E.	"	10	7	"	26. 4.33	" "
"	10 E.	"	10	5	"	2. 3.33	" "
"	12 E. (a)	"	5	5	Plants	24. 6.33	Lat. Square.
"	12 E. (b)	"	5	7	"	24. 6.33	Ran. Blocks.
"	1 W.	"	4	8	1st Ratoons	7. 9.33	" "
"	2 W.	"	7	9	"	20. 9.33	" "
"	3 W.	"	7	9	"	18.11.33	" "
"	6 W. (1)	"	6	6	Plants	29. 9.33	Lat. Square.
"	6 W. (2)	"	6	6	"	29. 9.33	" "
"	10 W.	"	7	10	1st Ratoons	22. 9.33	Ran. Blocks.
"	11 W.	"	7	10	Plants	18.11.32	" "
"	14 W.	"	6	6	1st Ratoons	20.11.33	Lat. Square.
"	15 W.	"	7	7	"	22.11.33	" "
"	16 W.	"	9	7	Plants	27. 1.33	Ran. Blocks.
Port Mourant	28 A.E.	"	6	6	"	9. 2.33	Lat. Square.
"	15 A.	"	11	6	"	17. 5.33	Ran. Blocks.
"	8 A.	"	10	7	2nd Ratoons	6.10.33	" "
"	14 A.	"	9	7	1st Ratoons	14. 4.33	" "
Blairmont	4 H.	"	9	7	"	17.11.33	" "
"	18 R.	"	12	7	2nd Ratoons	12.10.33	" "
Lusignan	22 P.M.R.	"	10	7	"	18. 8.33	" "
"	38 A.	"	10	7	1st Ratoons	18. 4.33	" "
Diamond	10 G.D.	"	11	7	"	1.10.33	" "
"	89 G.D.	"	6	7	2nd Ratoons	14.11.33	" "
Uitvlugt	13 E.	"	11	7	1st Ratoons	20.10.33	" "
"	10 Z.	"	9	7	"	5. 9.33	" "
Non Pareil	59 E.	"	11	8	"	25.10.33	" "
"	14 E.	"	9	5	2nd Ratoons	12.12.33	" "
Cane Grove	21 P.	"	6	6	Plants	26. 5.33	Lat. Square.
Ogle	61 O.	"	8	8	1st Ratoons	27. 9.33	" "
Wales	4 B.	"	8	8	Plants	30. 5.33	" "
La Bonne Intention	22 C.M.	"	6	6	"	25. 8.33	" "
Sophia	4 W.	Variety-Manurial	12	20	"	28.12.33	Ran. Blocks.
"	2 E. (1)	Manurial	5	9	1st Ratoons	21. 4.33	" "
"	2 E. (2)	"	5	7	"	21. 4.33	" "
"	12 W.	"	6	6	"	5.12.33	Lat. Square.
Port Mourant	6 A.	"	16	4	2nd Ratoons	28. 2.33	Ran. Blocks.
"	4 H.E.	"	4	4	Plants	23.12.32	Lat. Square.
Blairmont	15 H.P.	"	5	5	"	29. 8.33	" "
Lusignan	4 Emp.	"	5	5	"	18.12.32	" "
"	28 E.G.H.	"	4	4	"	25.12.32	" "
Uitvlugt	94 M.Z.	"	5	5	1st Ratoons	28.11.33	" "
"	37 E.	"	5	5	"	6.12.33	" "
"	14 Z.	"	4	4	Plants	25. 2.33	" "
"	76 Z.	"	7	12	2nd Ratoons	7. 9.33	Ran. Blocks.
Cane Grove	21 P.	"	5	5	Plants	25. 5.33	Lat. Square.
"	22 P.	"	5	5	"	31.12.32	" "
Farm	86 C.D.	"	20	6	2nd Ratoons	5. 5.33	Ran. Blocks.
Le'onora	21 G.V.	"	7	12	"	5. 5.33	" "
Versailles	51 R.D.Z.	"	5	5	Plants	14. 2.33	Lat. Square.
Rose Hall	30 R.H.	"	4	4	"	27. 1.33	" "
"	19 L.20	"	5	5	"	20.10.33	" "
Edmore	8 B.A.	"	4	4	"	2.12.32	" "
Port Mourant	28 T.L.	Flood-fallow	4	4	"	12.33	" "
"	28 T.W.	"	4	4	"	12.32	" "
"	F.	"	4	4	"	12.32	" "
"	H.	"	4	4	"	12.32	" "

26. With regard to the variety trials, Table VI. summarises, for each variety, the number of experiments in which it occurs, and their cycle-age.

TABLE VI.

VARIETIES IN REPLICATED TESTS, DECEMBER 31, 1933.

Variety.	No. of Experiments as			Total No. of Experi- ments.	Variety.	No. of Experiments as			Total No. of Experi- ments.
	Plants.	1st Ratoons.	2nd Ratoons.			Plants.	1st Ratoon.	2nd Ratoons.	
D. 625	23	14	12	49	D. 53/27	...	2	1	3
Diamond 10	4	4	4	12	D. 57/27	1	...	...	1
Berbice	...	2	...	2	D. 87/27	1	...	...	1
B. H. 10 (12)	...	...	4	4	D. 1/28	2	2	...	4
Co. 210	1	1	...	2	D. 3/28	2	4	...	6
Co. 213	1	1	...	2	D. 4/28	2	4	...	6
Co. 281	1	1	...	2	D. 6/28	...	1	...	1
G. 119	1	2	...	3	D. 8/28	...	2	...	2
P.O.J. 213	...	...	2	2	D. 9/28	3	2	...	5
P.O.J. 253	1	1	...	2	D. 10/28	2	3	...	5
P.O.J. 1499	...	...	1	1	D. 11/28	3	3	...	6
P.O.J. 2714	...	...	1	1	D. 13/28	1	1	...	5
P.O.J. 2727	...	...	1	1	D. 15/28	1	3	...	4
P.O.J. 2753	...	1	...	1	D. 20/28	...	1	...	1
P.O.J. 2878	3	3	2	8	D. 23/28	1	3	...	4
S.C. 12 (4)	...	...	6	6	D. 24/28	1	3	...	4
S.W. 3	...	...	1	1	D. 50/28	...	1	...	1
D. 76/02	...	1	...	1	D. 154/28	1	1	...	2
D. 814/12	2	1	1	4	D. 76/29	1	...	...	1
D. 663/13	...	2	2	4	D. 171/29	1	...	...	1
D. 695/13	...	2	4	6	D. 1/30	1	...	...	1
D. 747/13	1	1	...	2	D. 3/30	1	...	...	1
D. 73/17	1	1	...	2	D. 5/30	1	...	...	1
D. 92/17	1	...	1	2	D. 8/30	1	...	...	1
D. 195/17	...	2	...	2	D. 36/30	1	...	...	1
D. 233/17	...	...	1	1	D. 39/30	1	...	...	1
D. 376/17	...	...	1	1	D. 41/30	1	...	...	1
D. 404/17	2	...	...	2	D. 43/30	1	...	...	1
D. 576/17	...	...	1	1	D. 49/30	1	...	...	1
D. 413/18	...	...	1	1	D. 51/30	...	...	...	1
D. 611/18	1	1	...	1	D. 52/30	2	...	...	2
D. 666/18	1	...	6	7	D. 62/30	1	...	...	1
D. 668/18	1	...	...	1	D. 66/30	1	...	...	1
D. 789/18	...	...	1	1	D. 67/30	1	...	...	1
D. 794/18	...	1	...	1	D. 71/30	1	...	...	1
D. 835/18	...	3	3	6	D. 72/30	1	...	...	1
D. 52/20	...	...	1	1	D. 74/30	1	...	...	1
D. 71/20	...	...	1	1	D. 75/30	1	...	...	1
D. 73/20	...	...	1	1	D. 78/30	1	...	...	1
D. 75/20	...	...	1	1	D. 79/30	1	...	...	1
D. 203/20	1	...	1	2	D. 81/30	1	...	...	1
D. 204/20	...	1	2	3	D. 83/30	1	...	...	1
D. 207/20	1	...	1	2	D. 84/30	1	...	...	1
D. 213/20	...	1	...	1	D. 87/30	1	...	...	1
D. 246/20	...	1	...	1	D. 88/30	1	...	...	1
D. 349/20	2	...	...	2	D. 89/30	1	...	...	1
D. 351/20	...	...	2	2	D. 103/30	1	...	...	1
D. 516/20	...	2	...	2	D. 113/30	1	...	...	1
D. 557/20	...	...	5	5	D. 118/30	1	...	...	1
D. 604/20	...	...	1	1	D. 127/20	1	...	...	1
D. 679/20	...	...	1	1	D. 138/30	1	...	...	2
D. 682/20	...	1	...	1	D. 142/30	2	...	...	1
D. 699/20	...	...	1	1	D. 143/30	1	...	...	1
D. 6/21	2	2	2	6	D. 145/30	1	...	...	1
D. 25/21	...	1	...	1	D. 146/30	1	...	...	1
D. 92/21	...	1	...	1	D. 147/30	1	...	...	1
D. 163/21	...	1	...	1	D. 148/30	1	...	...	1
D. 173/21	...	...	1	1	D. 149/30	1	...	...	1
D. 206/21	1	...	...	1	D. 150/30	1	...	...	1
D. 241/21	...	1	1	2	D. 151/30	1	...	...	1
D. 309/21	1	...	...	1	D. 152/30	1	...	...	1
D. 364/21	...	1	...	1	D. 156/30	1	...	...	1
D. 424/21	...	...	5	5	D. 167/30	2	...	...	2
D. 438/21	2	...	...	2	D. 160/30	1	...	...	1
D. 444/21	1	...	...	1	D. 163/30	1	...	...	1
D. 548/21	...	1	...	1	D. 164/30	1	...	...	1
D. 613/21	...	1	...	1	D. 165/30	2	...	...	2
D. 628/21	1	2	...	3	D. 167/30	1	...	...	1
D. 661/21	...	1	...	1	D. 168/30	1	...	...	1
D. 634/21	2	...	1	3	D. 170/30	1	...	...	1
D. 857/21	...	2	...	2	D. 171/30	1	...	...	1
D. 880/21	...	1	...	1	D. 173/30	1	...	...	1
D. 893/21	...	...	1	1	D. 174/30	1	...	...	1
D. 1034/21	...	...	1	1	D. 178/30	1	...	...	1
D. 309/22	...	...	1	1	D. 181/30	1	...	...	1
D. 573/22	...	2	1	3	D. 182/30	1	...	...	1
D. 593/22	...	...	1	1	D. 190/30	1	...	...	1
D. 602/22	...	6	9	15	D. 205/30	1	...	...	1
D. 648/22	...	1	...	1	D. 207/30	1	...	...	1
D. 895/22	1	2	...	4	D. 220/30	1	...	...	1
D. 918/22	...	...	...	...	D. 221/30	1	...	...	1
D. 927/22	...	...	2	2	D. 222/30	1	...	...	1
D. 1034/22	...	1	1	2	D. 223/30	1	...	...	1
D. 1159/22	3	...	...	3	D. 224/30	1	...	...	1
D. 1175/22	...	...	1	1	D. 230/30	1	...	...	1
D. 1221/22	1	...	1	2	D. 231/30	1	...	...	1
D. 1431/22	...	...	1	1	D. 232/30	1	...	...	1
D. 1865/22	...	1	...	1	D. 235/30	1	...	...	1
D. 36/23	1	...	...	1	D. 236/30	1	...	...	1
D. 11/24	...	1	...	1	D. 237/30	1	...	...	1
D. 8/27	1	...	...	1					

MISCELLANEOUS.

27. *Cane Sold*.—During the year 599 puntloads of cane were sold to Pln. Ogle for \$3,635.68.

28. *Soil Samples* have been taken from all new experimental sites and submitted to the Chemist-Ecologist for examination.

29. *Cane Samples*.—Two thousand four hundred and ninety samples weighing approximately 52 tons have been crushed and analysed during the period under review.

30. *Plant Distribution*.—One thousand three hundred and forty-three bags containing 174,590 cane cuttings were distributed to various estates during the year.

31. *Root Samples*.—In an attempt to investigate the root distribution of three varieties, D. 625, Diamond 10 and P. O. J. 2878, root samples were taken from Sophia and at Plns. Non Pareil and Blairmont. A total of 1,272 samples were collected and examined.

32. *Rice from Flood-fallowed Land*.—As mentioned in the Report for 1932, the flood-fallowing of cane lands is an established local practice. An attempt is being made at the Station to combine the practice with the production of a crop of rice from the flooded area, for it was felt that the value of the rice produced should partially offset the cost of flooding, while the organic matter produced would be of considerable value to the soil, especially if the rice were thrashed *in situ* and all the straw returned to the field.

33. During the year 10½ acres were sown to rice and yielded 171½ bags of padi. Of this amount, 163 were sold for \$129.12, while the remaining 8½ bags were used for seed purposes. There was, apparently, a greatly improved tilth in the fields in which rice was grown.

34. *Monthly Reports* on the work in progress have been regularly submitted to the Chairman. *Sugar Bulletin* No. II. was issued during the year by the Cane Agronomist in collaboration with the Chemist-Ecologist.

35. *Visits* entailing 259 days were paid to sugar estates by various members of the staff during the year.

36. *Rainfall*.—The following is a summary of the monthly rainfall for the year compared with the monthly average for the last 13 years:—

TABLE VII.
COMPARISON OF THE RAINFALL AT SOPHIA FOR THE YEAR 1933 WITH THE AVERAGE.

Month.				1933	Average 1921-33
				Inches.	Inches.
January	...	...	...	7.56	7.29
February	...	...	...	4.77	3.62
March	...	...	...	5.43	4.08
April	...	...	...	5.36	5.08
May	...	...	...	14.46	12.01
June	...	...	...	12.39	14.50
July	...	...	...	9.06	10.67
August	...	...	...	13.43	8.63
September	...	...	...	1.12	2.72
October	...	...	...	3.41	3.88
November	...	...	...	10.25	6.08
December	...	...	...	23.09	15.48
Total	...	...	...	115.33	94.04

37. It might be mentioned that at Sophia fields reaped during the months of October and November are being threatened with extinction by the recent heavy rainfall during December.

38. The writer desires to express his gratitude to the various managers and staffs of the sugar estates, to members of the Department of Agriculture and his colleagues of the Sugar Experiment Station for the courtesies shown and co-operation received.

C. CAMERON,
Field Manager.

February 15, 1934.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE CHEMICAL DIVISION FOR THE YEAR 1933.

CONTENTS.

GENERAL ...	...	PAGE.
Advisory Visits ; Examination of Samples ; Soil Surveys.	...	83
SUGAR-CANE SOIL INVESTIGATIONS ...	...	85
Flood-fallowing, Soil Salinity and Magnesium Toxicity.		
CANE GROWTH EXPERIMENT ...	...	92
SWEET POTATO SOILS ...	...	93
MANURIAL TRIALS ...	...	94
Sugar-Cane ; Padi ; Pineapples.		
OTHER INVESTIGATIONAL WORK ...	...	98
Mineral Constituents of Fodder Crops ; Pineapples ; Composition of Local Honey ; Cassava Flour ; Occurrence of Marl in the Rupununi District.		
ACKNOWLEDGEMENTS ...	...	101

REPORT OF THE CHEMICAL DIVISION FOR THE YEAR 1933.

STAFF.

R. R. Follett-Smith—Chemist-Ecologist.
C. L. C. Bourne—Assistant Chemist.

GENERAL.

2. The staff of the Division were on duty during the whole of the period under review.

The number of samples examined during the year has shown a very considerable increase. The details of this increase are given in a later paragraph. This greater activity is largely due to additions in the supernumerary staff made possible by the receipt of grants from the Colonial Development Fund, the Empire Marketing Board and from the Imperial Chemical Industries, Ltd., and Messrs. Booker Bros., McConnell & Co., Ltd.

The Division has been occupied with general agricultural chemical work on the coastlands of the colony and no surveys have been made in the interior although certain samples, collected by Government Officers on tour, have been examined. A considerable amount of time has been devoted to the design and statistical examination of manurial trials with sugar-cane, padi, sweet potatoes and pineapples. Composite soil samples from the various experimental sites have been examined in the laboratory. A number of advisory visits have been paid to the plantations of the colony. Investigations concerning the incidence of the cane "disease," attributed in some quarters to the presence in the soil of an unfavourable ratio of magnesia to lime, have been made.

A collection of local honeys has been analysed and further work in this connection is anticipated. Samples of cassava flour produced in the colony have been examined. An experiment, in collaboration with the Government Veterinary Surgeon and the Government Botanist, has necessitated the analysis of periodical samples of pasturage. Reports referring to the fertiliser requirements of sugar-cane and padi have been prepared for inclusion in published bulletins.

Since the pineapple canning factory commenced operations several visits have been paid to the concession and numerous analyses of the raw materials, finished products and by-products of the factory have been made.

Since the re-organisation of the Division in 1929 work in the laboratory has been carried out under very unenviable conditions. Early in the year permission was obtained to remove the Chemical Laboratory from Broad Street to a house in the Botanical Gardens. The new quarters are much less congested and provide much more suitable accommodation. A few alterations and additions to the fittings are still required.

The Sugar-Cane Agronomist has been absent on leave since August, 1933, and the work at the Sugar Experiment Station during this period has been supervised by the Chemist-Ecologist.

Advisory Visits.

3. During the year thirty advisory visits were paid to the plantations of the colony.

Examination of Samples.

4. The following samples, which do not include the large number of composite soil samples analysed in connection with the Booker's survey, have been examined during the year :—

TABLE I.

Soils	...	...	527
Sugar-canes	...	...	2,490
Pineapples	...	...	17
Honeys	...	...	15
Pineapple products	...	...	11
Forage crops	...	...	11
Cassava flours	...	...	11
Cane ashes	...	...	10
Fertilisers	...	...	8
Citronella grass	...	...	4
Miscellaneous	...	...	20

The miscellaneous samples include green dressings, water purification sludge feeding stuffs, furnace ash, boiler-feed water, sugar, tin-plate, soil waters, minerals and padi. In addition to this work the help of the Division was sought in the repair and adjustment of a chemical balance, the cleaning and adjustment of a saccharimeter, the calibration of an ammeter and in the preparation of several buffer and indicator solutions.

The work of the Division during the last few years is summarised in Table II.

TABLE II.

	1929	1930	1931	1932	1933
Soil samples	396	649	436	362	527
Cane samples	1,110	71	793	1,134	2,490
Other samples	...	54	116	20	107

With regard to this table it should be noted :—

- (i) that the cane samples for 1929 were only examined as regards the composition of the juice; later samples were subjected to a thorough examination;
- (ii) that the general laboratory was short-staffed during 1932;
- (iii) that the figures given for the years 1932 and 1933 do not include the very large number of soil samples examined in connection with the Booker's survey.

Soil Surveys.

5. During the year a soil survey was made of Pln. Cove and John, East Coast, Demerara.

6. The detailed soil survey of the estates of Messrs. Booker Bros., McConnell & Co., Ltd., which was commenced in July, 1931, was finally completed during the period under review. The survey involved the collection of 5,786 soil samples, spaced over 34,617 acres. These samples were individually examined regarding their texture, reaction and salinity. 1,484 of the samples were examined regarding their content of readily available phosphate. These individual samples were grouped, according to their texture and exchange reaction into 199 composite samples which were studied in regard to their theoretical lime requirement, their contents of carbon, nitrogen, soluble salts, chlorine and readily available and citric-available phosphate. Their rates of solution were investigated and their contents of exchangeable and water-soluble lime, magnesia, potash and soda were determined. In some cases, where considerable amounts were found, "exchange-

able" iron and alumina were estimated. Mr. J. F. Williams was responsible for the analytical work connected with the survey and had, at times, the assistance of members of the staff of the Division. The results obtained formed the basis of detailed reports for the eleven estates examined. 230 small-scale and 115 large-scale coloured maps were constructed to accompany the reports. Finally a general summary of the whole work was prepared for distribution to the estates' staff.

This survey work has served to define the nature and extent of the soil types supporting sugar-cane, has given general information regarding their nutrient supplies and has assisted the design and selection of sites for suitable field experiments with fertilisers.

The authorities concerned have realised the necessity of implementing this survey work with chains of suitably designed field experiments in order to obtain economic data. Funds for this extension of the work have been jointly provided by the Imperial Chemical Industries, Limited, and Messrs. Booker Bros., McCornell & Co., Ltd. The scope of this experimental work is described in a subsequent section.

SUGAR CANE SOIL INVESTIGATIONS.

7. The detailed soil surveys of the sugar-cane lands of the colony carried out by the Division cover just over fifty per cent. of the entire area devoted to cane cultivation. In the report of this Division for the previous year detailed information was presented regarding the texture, reaction and salinity of the topsoils and subsoils of the three principal cane-growing districts of the colony. As a result of the work completed during the period under review it is possible to define the characteristics of these soils with even more precision. The composite samples, composed of individual samples grouped according to their texture and reaction, were studied in regard to numerous characteristics already described. These composite samples were segregated into six groups, a topsoil group and a subsoil group for each of three districts, namely, the West Coast of Demerara, the East Coast of Demerara and the East Coast of Berbice. Weighted means for similar composites in each group were calculated and the results appear in Tables III.—VIII. These figures indicate the general characteristics of each soil class in each district and are of great value in advisory work. They should prove useful in the future if a question regarding changes in the composition of the colony's cane soils arises.

TABLE III.
WEIGHTED MEANS OF WEST COAST COMPOSITE SAMPLES.
TOPSOILS.

Exchange Reaction.	3.00—3.99						4.00—4.99		
Index of Texture.	21-30	31-40	41-45	46-55	56-65	Above 65	21-30	31-40	Above 65
Lime requirement %	0.494	0.521	0.611	0.855	0.973	1.227	0.329	0.410	0.841
Per cent. Carbon	1.080	0.801	0.912	1.652	3.853	9.658	0.905	0.955	6.029
Per cent. Nitrogen	0.122	0.110	0.127	0.192	0.299	0.480	0.103	0.116	0.293
Carbon : nitrogen ratio	8.85	7.29	7.19	8.60	12.81	20.15	8.78	8.23	15.35
Per cent. Salts	0.013	0.015	0.015	0.015	0.018	0.031	0.010	0.019	0.017
Rate of solution	5	8.6	18	6.7	-6.2	-6.9	85	81	10
Truog P ₂ O ₅	35	26.2	27	39.1	68.4	65.4	27	22	65
Citric P ₂ O ₅	110	80.6	95	158.9	231.9	253.0	52	46	358
Exchangeable and water soluble bases mgm. eqs. /100 gms.									
Lime	2.20	3.68	3.68	2.43	1.94	1.88	4.50	5.69	4.70
Magnesia	1.88	4.58	5.01	2.43	1.38	1.14	5.25	6.61	1.94
Potash	0.30	0.16	0.25	0.28	0.16	0.14	0.16	0.16	0.30
Soda	0.15	0.18	0.21	0.14	0.10	0.10	0.56	0.41	0.03
Magnesia : lime ratio	0.85	1.24	1.36	1.00	0.71	0.61	1.17	1.16	0.41
No. of composite samples	1	3	4	7	5	3	1	1	1
No. of individual samples	3	43	58	245	105	136	6	9	22

TABLE IV.
WEIGHTED MEANS OF WEST COAST COMPOSITE SAMPLES.
SUBSOILS.

Exchange Reaction.	3.00-3.99.					4.00-4.99.		
Index of Texture.	31-40.	41-45.	46-55.	56-65.	Above 65.	31-40	41-45.	46-55.
Lime requirement % ...	0.503	0.559	0.737	0.961	1.202	0.368	0.294	0.252
Per cent. Carbon ...	0.571	0.583	1.121	2.521	3.139	0.459	0.429	0.410
Per cent. Nitrogen ...	0.083	0.091	0.125	0.173	0.310	0.079	0.078	0.081
Carbon : nitrogen ratio ...	6.89	6.40	8.93	14.53	26.24	5.80	5.50	5.06
Per cent. Salts ...	0.021	0.018	0.016	0.030	0.062	0.026	0.041	0.028
Rate of Solution ...	13.6	4.7	0.8	10.7	12.5	13	22.2	2
True P_2O_5 ...	22.0	18.7	18.9	25.4	27.8	28	19.3	21
Citric P_2O_5 ...	...	...	...	...	...	...	...	...
Exchangeable and water soluble bases	...	...	...	...	...	...	...	...
mgm. eqs./100 gms.—								
Lime ...	3.04	2.64	2.02	1.61	1.40	3.70	4.52	3.85
Magnesia ...	6.02	5.73	3.63	2.58	2.01	7.25	9.83	9.96
Potash ...	0.16	0.13	0.15	0.14	0.15	0.16	0.18	0.14
Soda ...	0.19	0.38	0.26	0.14	0.41	0.75	1.27	0.96
Magnesia : lime ratio ...	1.98	2.17	1.80	1.60	1.44	1.96	2.18	2.59
No. of composite samples ...	2	4	6	5	3	1	3	1
No. of individual samples ...	15	41	442	174	22	9	17	10

TABLE V.
WEIGHTED MEANS OF EAST COAST COMPOSITE SAMPLES.
TOPSOILS.

Exchange Reaction.	3.00-3.99						4.00-4.99			5.00-5.99	6.00-6.99
Index of Texture.	21-30	31-40	41-45	46-55	56-65	Above 65	31-40	41-45	46-55	41-45	41-45
Lime requirement % ...	0.453	0.496	0.640	0.779	1.229	1.501	0.339	0.347	0.335	0.155	0.068
Per cent. Carbon ...	1.174	0.964	1.151	1.469	3.393	8.153	0.989	0.960	1.060	1.171	1.176
Per cent. Nitrogen ...	0.142	0.137	0.156	0.176	0.234	0.422	0.122	0.141	0.148	0.175	0.188
Carbon : nitrogen ratio ...	8.27	7.03	7.39	8.35	11.93	19.3	8.11	6.81	7.16	6.69	6.26
Per cent. Salts ...	0.015	0.034	0.038	0.039	0.029	0.038	0.056	0.045	0.052	0.061	0.098
Rate of solution ...	48	43.3	30.4	25.6	3.8	0	107.8	123.5	98.4	265	321
True P_2O_5 ...	16	19.7	22.8	16.7	19.7	23	21.8	26.4	17.9	37	74
Citric P_2O_5 ...	67	84.6	83.6	78.6	67.1	59	85.5	103.5	77.2	111	115
Exchangeable and water soluble bases mgm. eqs. /100 gms.											
Lime ...	3.07	4.49	4.63	4.40	2.84	1.14	6.06	6.73	6.60	14.09	22.66
Magnesia ...	4.60	6.80	6.43	6.35	2.76	1.18	7.92	8.39	10.34	9.79	6.90
Potash ...	0.32	0.43	0.44	0.49	0.46	0.43	0.37	0.43	0.50	0.29	0.29
Soda ...	0.21	0.47	0.44	0.51	0.19	0.14	0.64	0.82	0.81	0.40	0.33
Magnesia : lime ratio ...	1.50	1.52	1.39	1.44	0.97	1.04	1.31	1.25	1.57	0.70	0.31
No. of composite samples ...	1	4	6	10	7	1	4	4	5	1	1
No. of individual samples ...	4	56	158	556	132	8	35	48	99	3	3

TABLE VI.
WEIGHTED MEANS OF EAST COAST COMPOSITE SAMPLES.
SUBSOILS.

Exchange Reaction.	3.00-3.99						4.00-4.99				5.00-5.99		
Index of Texture.	21-30	31-40	41-45	46-55	56-65 Pegasse	56-65 Heavy clay	31-40	41-45	46-55	56-65	41-45	46-55	56-65
Lime requirement % ...	0.471	0.470	0.601	0.746	1.028	0.562	0.324	0.244	0.260	0.281	0.133	0.115	0.112
Per cent. Carbon ...	0.907	0.858	0.784	0.948	2.144	0.533	0.533	0.467	0.486	0.457	0.417	0.439	0.429
Per cent. Nitrogen ...	0.116	0.100	0.111	0.128	0.167	0.097	0.122	0.107	0.086	0.083	0.075	0.080	0.075
Carbon : nitrogen ratio ...	7.82	8.58	7.05	7.40	12.84	5.49	4.37	4.37	5.65	5.52	5.56	5.49	5.72
Per cent. Salts ...	0.011	0.031	0.057	0.073	0.043	0.122	0.243	0.166	0.158	0.172	0.149	0.194	0.172
Rate of Solution ...	2	5.7	25.5	20.2	16.0	32.6	20	33.6	57.6	11.9	26	41.5	59.1
True P_2O_5 ...	10	9.7	15.9	13.4	15.6	11.6	14	12.0	16.7	16.6	36	35.1	39.2
Citric P_2O_5 ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Exchangeable and water soluble bases mgm. eqs. /100 gms.													
Lime ...	2.92	3.04	3.40	3.53	2.94	3.78	4.82	4.21	4.55	5.26	4.44	5.75	5.71
Magnesia ...	5.46	4.82	7.15	7.70	5.08	10.31	9.76	10.86	12.47	14.07	12.99	13.54	14.63
Potash ...	0.12	0.28	0.27	0.31	0.33	0.35	0.31	0.37	0.32	0.37	0.36	0.29	0.30
Soda ...	0.19	0.50	0.88	1.07	0.44	2.20	2.02	1.79	2.45	3.13	2.31	3.68	3.62
Magnesia : lime ratio ...	1.87	1.59	2.10	2.18	1.73	2.73	2.03	2.58	2.74	2.67	2.93	2.36	2.57
No. of composite samples ...	1	3	4	7	6	3	1	2	5	2	1	4	2
No. of individual samples ...	3	21	46	422	118	56	4	20	224	39	5	70	16

TABLE VII.
WEIGHTED MEANS OF BERBICE COMPOSITE SAMPLES.
TOPSOILS.

Exchange Reaction.	3.00—3.99			4.00—4.99			5.00—5.99			
Index of Texture.	41-45	46-55	56-65	31-40	41-45	46-55	21-30	31-40	41-45	46-55
Lime requirement %	0.651	0.758	0.739	0.343	0.345	0.362	0.142	0.146	0.191	0.206
Per cent. Carbon	1.466	1.980	2.529	1.454	1.495	1.631	1.185	1.443	1.454	1.843
Per cent. Nitrogen	0.176	0.214	0.236	0.179	0.194	0.218	0.147	0.179	0.192	0.222
Carbon : nitrogen ratio	8.33	9.25	8.84	8.12	7.71	7.48	8.06	8.06	7.57	8.52
Per cent. Salts	0.040	0.038	0.027	0.042	0.043	0.043	0.048	0.076	0.052	0.061
Rate of Solution	62.5	46.2	20	140.5	121.4	107.1	379	289	165.5	231.8
Truog P_2O_5	17.2	21.7	25	15.5	20.4	21.9	22	22	...	61.4
Citric P_2O_5	46.1	40.8	106	31.8	42.9	44.1	34	33	...	97.7
Exchangeable and water soluble bases mgm. eqs./100 gms.										
Lime	5.16	4.67	5.68	5.24	15.57	5.56	6.71	6.16	7.29	8.04
Magnesia	8.66	7.65	8.07	10.32	11.64	11.65	8.59	11.56	13.75	14.07
Potash	0.28	0.31	0.35	0.43	0.27	0.35	0.44	0.31	0.39	0.42
Soda	0.43	0.52	0.32	0.60	0.83	0.95	0.27	0.76	1.13	0.76
Magnesia : lime ratio	1.68	1.64	1.42	1.97	2.09	2.10	1.28	1.88	1.89	1.75
Per cent. Chloride	0.007	0.008	0.012	0.007	0.009	0.011	0.009	0.017	0.010	0.011
No. of composite samples	2	3	1	3	6	5	1	1	2	2
No. of individual samples	34	119	4	40	235	468	5	5	12	29

TABLE VIII.
WEIGHTED MEANS OF BERBICE COMPOSITE SAMPLES.
SUBSOILS.

Exchange Reaction.	3.00—3.99			4.00—4.99			5.00—5.99			6.00—6.99		
Index of Texture.	41-45	46-55	56-65	31-40	41-45	46-55	31-40	41-45	46-55	31-40	41-45	46-55
Lime requirement %	0.438	0.595	1.189	0.162	0.217	0.226	0.104	0.105	0.104	0.048	0.036	0.045
Per cent. Carbon	0.769	0.862	1.025	0.690	0.659	0.666	0.519	0.554	0.556	0.413	0.419	0.486
Per cent. Nitrogen	0.123	0.117	0.157	0.096	0.105	0.111	0.089	0.099	0.099	0.073	0.087	0.094
Carbon : nitrogen ratio	6.25	7.37	6.53	7.19	6.28	6.00	5.83	5.60	5.62	5.66	4.82	5.17
Per cent. Salts	0.076	0.139	0.083	0.149	0.102	0.132	0.129	0.145	0.175	0.138	0.192	0.213
Rate of solution	58	37.6	40	156	36.6	44.5	59.6	54.3	54.5	105	59	53.9
Truog P_2O_5	10	10.5	15	10	12.4	16.1	14.4	43.5	53.0	50	104	122.5
Citric P_2O_5	...	...	...	...	...	...	...	...	...	...	...	...
Exchangeable and water soluble bases mgm. eqs./100 gms.												
Lime	3.45	4.24	3.61	3.56	3.60	4.17	4.06	4.43	5.02	5.78	6.47	6.23
Magnesia	7.71	9.16	4.99	11.21	10.61	11.71	10.99	12.08	13.71	10.74	16.72	15.71
Potash	0.20	0.25	0.29	0.20	0.21	0.24	0.19	0.23	0.21	0.18	0.29	0.28
Soda	0.92	1.97	0.94	1.92	1.56	2.20	1.14	2.82	2.59	1.82	3.15	3.58
Magnesia : lime ratio	2.23	2.16	1.58	3.15	2.95	2.81	2.71	2.90	2.73	1.86	2.59	2.52
Per cent. Chloride	0.018	0.027	0.015	0.027	0.019	0.026	0.034	0.032	0.032	0.027	0.031	0.039
No. of composite samples	1	2	1	1	2	6	2	2	5	1	1	3
No. of individual samples	4	75	12	6	48	245	22	60	362	6	22	81

8. It is of interest to consider and compare the characteristics of the main soil classes of the three districts.

The more generally distributed topsoil and subsoil classes of the estates of the West Coast, Demerara, are highly acidic clays and pegassy clays. They possess large theoretical lime requirements. They contain considerable amounts of organic matter with a carbon:nitrogen ratio wider than the average. The pegassy clays contain more organic matter, with a wider carbon:nitrogen ratio, than do the clays. They are not saline soils and the figures for their rates of solution are small indicating a low level of fertility. The topsoils contain large amounts of available phosphate due, no doubt, to past dressings of fertilisers in view of the presence of small supplies in the subsoils. The amounts of exchangeable and water-soluble bases in these soils are very low and indicate their unsaturated nature. The amounts of exchangeable potash found in the pegasse soils are very low.

The most widely distributed topsoil and subsoil class found on the estates of the East Coast, Demerara, is a highly acidic clay. Another subsoil class, fairly

prevalent, is a markedly acidic clay. Compared with the most common topsoils of the West Coast, Demerara, this topsoil of the East Coast, Demerara, has a slightly smaller theoretical lime requirement, rather less organic matter and possesses a somewhat narrower ratio of carbon to nitrogen. It contains slightly more soluble salts and its larger value for the rate of solution indicates a rather higher level of fertility. It possesses much smaller supplies of available and readily available phosphate. The contents of exchangeable and water-soluble bases are greater. The two main subsoil classes of the East Coast, Demerara, differ considerably. The markedly acidic clay lies nearer to the sea-coast than the highly acidic clay and the analytical figures emphasise this difference in position. The former subsoil is less unsaturated, is more saline, contains less organic matter and possesses a much narrower ratio of carbon to nitrogen than does the latter. This subsoil type, the highly acidic clay, which is the more prevalent of the two, does not differ greatly from the main subsoil types of the West Coast, Demerara. It contains more water-soluble and exchangeable bases and possesses a narrower carbon:nitrogen ratio.

The two main topsoil classes of Berbice are the markedly acidic heavy silts and clays. Their main difference is one of texture; in other respects they are essentially similar although the clays possess a slightly larger theoretical lime requirement, contain a little more organic matter and have a slightly narrower ratio of carbon to nitrogen. Compared with the widely distributed topsoil classes of the West and East Coast of Demerara they are much less unsaturated, possessing theoretical lime requirements which are less than half of those of the main Demerara topsoil classes. They contain approximately the same amount of organic matter but possess much narrower ratios of carbon to nitrogen. Their rates of solution are very much greater and indicate a higher level of fertility. Their contents of available and readily available phosphate are low, their contents of exchangeable and water-soluble bases are higher than those of the main topsoil classes of the other two areas. The two main subsoil classes of Berbice are the markedly acidic clay and the slightly acidic clay; of these two classes the latter is the more prevalent. Of the two, this latter class is less unsaturated, contains less organic matter, possesses a narrower carbon:nitrogen ratio, is more saline, has larger supplies of readily available phosphate and contains larger amounts of exchangeable and water soluble bases. These two subsoil classes resemble the markedly acidic clay subsoils of the East Coast of Demerara, the subsoil class found supporting the cane cultivation nearest the coast. The Berbice subsoils are less unsaturated and contain more organic matter.

9. The foregoing paragraphs may prove of interest to the soil scientist. The practical man, however, requires some general and less abstruse statement of the position. Such a statement might be framed in the following manner. The soils of Berbice are, from the chemical standpoint, more fertile than those of the East Coast of Demerara which, in their turn, are slightly better adapted to agriculture than are the soils of the West Coast of Demerara.

An interesting point which arises in connection with a study of the sugar cane soils of British Guiana is the persistence of the soil organic matter in spite of the fact that applications of organic manures have not been made to the majority of the soils for many years and in spite of the fact that for some very considerable time the burning of cane has always preceded reaping operations.

10. It is of interest to consider the relative proportions of the exchangeable bases in the main topsoil classes of the three districts. For this purpose it is assumed that the lime requirement method of Hardy and Lewis furnishes a measure of the exchangeable hydrogen. The values obtained are presented in Table IX.

TABLE IX.

	Exchange Reaction.	Index of Texture.	% of total exchangeable bases.					Total bases mgm. eq per 100 gms.
			Hydrogen.	Calcium.	Magnesium.	Potassium.	Sodium.	
West Coast	3.00-3.99	46-55	76.4	10.9	10.9	1.2	0.6	22.4
Demerara	3.00-3.99	56-65	84.5	8.4	6.0	0.7	0.4	23.1
East Coast,								
Demerara	3.00-3.99	46-55	57.0	16.1	23.2	1.8	1.9	27.4
East Coast	4.00-4.99	41-45	27.4	22.1	46.2	1.1	3.3	25.2
Perbice	4.00-4.99	46-55	28.0	21.6	45.3	1.4	3.7	25.7
Sea alluvium	8.00	48	Nil*	10.9*	39.6*	5.2*	44.4*	...

* Exchangeable and water soluble bases in the case of sea alluvium.

11. It appears that the first effect of impressing drainage and cultivation upon the marine alluvial soils of the colony's cane lands is a marked decrease in their contents of water-soluble and exchangeable soda and potash and a certain advent of exchangeable hydrogen into the soil complex. Further weathering brings about an equivalent reduction in the amount of soda and magnesia and an increase of hydrogen; the content of exchangeable potash does not appear to vary to any extent.

12. As far as the soils of temperate climates are concerned it is generally considered that the normal fertile soil is nearly or entirely saturated with bases which are comprised of some 80 per cent. of calcium. None of the main soils of the colony are saturated, in fact some of them are highly unsaturated. Their preponderating metallic exchangeable base is magnesium yet their yields compare favourably with those of other West Indian colonies possessing soils more akin to the fertile soils of the temperate zones.

13. The prerequisite of these soils would appear to be heavy doses of lime-bearing materials yet the field experiments with these ameliorants, laid down by the Department of Agriculture, yield disappointing results. There are several circumstances which militate against successful liming of cane soils in this colony. No calcereous deposits, within easy reach of the coastlands, have been found in this colony and liming materials have to be imported at considerable cost. It is a difficult matter to ensure the thorough incorporation of the dressings with the heavy clay soil. Perfect drainage of the soils of the sugar estates is difficult to accomplish and the restriction of aeration and of the movement of soil water tend to reduce the availability of the lime applications. The imperfect drainage common to some estates nullifies the good effects of applications of lime-bearing materials. Finally, at the present time, when costs of production approach and in some cases exceed the value of the product, the use of ameliorative methods which give only small immediate increases are not employed with any great enthusiasm.

14. It would be of considerable interest to test the effect of applications of gypsum before flood-fallowing to the soil in this colony. Hitherto the cost of gypsum in British Guiana has proved prohibitive. There is some hope that cheaper supplies of this material may be available in the future.

Flood-Fallowing.

15. Two series of field experiments with flood-fallowing have been laid down in consultation with the Cane Agronomist. They are designed to elucidate certain economic aspects of this phenomenon. One series compares the effects of different periods of immersion and of application of limestone before and after flooding. These experiments include plots submerged for twelve months, six months, four months, and certain plots not flooded at all. The time factor is of considerable importance to those estates where there is little or no room for extension of cultivation and where adequate supplies of water are not always available. On the basis of field observation it is generally considered that submergence for less than four months produces no beneficial results and may, in fact, be detrimental. It is also

felt that longer flooding periods are desirable and immersion is continued for two years in some cases. Definite information concerning the optimum period of submergence will be of very considerable interest to a large number of estates. The other series of experiments compares the effects of different depths of flooding, of the admixture of final molasses with the flooding water and of the encouragement of the growth of water plants. It is held that the depth of the flooding water has a marked effect on the subsequent yields and many estates go to considerable expense in raising dam beds and in pumping large amounts of water in order to keep up a depth of twelve inches.

16. While these two series of experiments are providing field evidence of the economics of flood-fallowing other investigations concerned with the mechanism of this method of soil improvement are being carried on in the laboratory. The method of attack consists of the examination of soil samples collected from circumscribed areas before and after submergence, such samples have already been collected and many of these have been examined in considerable detail. It is perhaps unwise to attempt to draw conclusions before the complete collection of samples has been examined. It may be said that interesting results are being obtained which at present point to a reduction, in some cases, of the amount of organic matter, and consequently a narrowing of the carbon:nitrogen ratio. There are indications, too, that the amount of "exchangeable" iron increases considerably. Such an effect would present an explanation of the improvement in soil texture.

17. Attempts are being made to expedite the uptake of lime by the soil by applying dressings of ground limestone before flood-fallowing. Experiments are being conducted to trace the fate of limestone so applied. The investigation is hampered by the lack of a method for determining the exchangeable calcium in an acid soil dressed with limestone. It would be of considerable interest to investigate the effects of mixing slaked lime or gypsum to the flooding water. It is hoped that such an investigation may be commenced in the near future. Field experiments with flood-fallowing are difficult and costly to establish.

Soil Salinity and Magnesium Toxicity.

18. It is convenient to consider the question of soil salinity together with the question of magnesium toxicity. The presence of large amounts of soluble salts in the colony's cane soils and their effect upon the yield of cane has been a subject of investigations almost since the inception of organised cane cultivation in British Guiana. The hypothesis that magnesium toxicity is a growth-retarding factor of importance on the sugar-cane soils of this colony is of comparatively recent origin.

19. *Soil Salinity*.—One of my predecessors, Dr. Shier, investigated, in the year 1845, the salt content of twenty-four samples of subsoil water collected from various sugar estates in the colony. Unfortunately no records of Dr. Shier's conclusions have, so far, been discovered. The subject was re-opened by Sir John Harrison whose opinions are published in the *West Indian Bulletin*, Vol. IX., pp. 22-37 and Vol. XIII., pp. 110-125. His conclusions may be briefly summarized by stating that he considered that the gradual loss in fertility, then apparent in the cane soils of the colony, was due in large measure to the accumulation of toxic quantities of sodium and magnesium salts and that this loss of productiveness, often accompanied by wilting and scorching of crops, could be mitigated by flooding. Sir John Harrison was interested in establishing a correlation between the ratio of temporary to permanent hardness of the soil water and the yield of cane. Departmental records indicate that he examined large numbers of subsoil waters from various estates while studying the problem. He made, however, no authoritative statement in this connection. He produced laboratory evidence to show that when subsoil waters were concentrated in an atmosphere of carbon dioxide the salts of lime present in the water were retained in solution until the water approached its point of saturation. When, however, the soil waters were concen-

trated in the absence of carbon dioxide the lime salts were thrown out of solution at a comparatively early stage of concentration. Sir John Harrison interprets these results as indicating that in soils well supplied with organic matter, undergoing active oxidation, the lime salts will remain in solution and will modify the toxic action of the salts of magnesium and sodium. In soils deficient in organic matter the lime salts will on concentration be immobilised early and in such soils the toxic action of sodium and magnesium salts may become marked.

20. *Magnesium Toxicity*.—Sir John Harrison, during his investigations on the salinity of the soil and of the subsoil waters, drew attention to certain instances where a reduction in yield was associated with a high ratio of magnesia to calcium in the subsoil water but he made no definite pronouncement in his report regarding magnesium toxicity. The subject was re-opened in 1925 when the Assistant Botanist and Mycologist of the Department was deputed to examine an occurrence of "root disease" on an estate in Berbice (Rept. Dept. Science and Agriculture 1925, Appendix III., pp. 1-6). After a thorough examination of the affected canes this officer concluded that the disturbance was not primarily due to any organism but was more probably connected with the incidence of unfavourable soil conditions. Specialised assistance with soil problems was not then available to the Department and the officer interested Mr. M. Bird in this phase of the investigation. Mr. Bird's first report is to be found in Jour. Board of Agric., Br. Guiana, pp. 256-261, 1925, and contains results of the analysis of soil from affected fields, soil sifted from the roots of dead cane, analyses of the juice of dead and live cane, analyses of the roots, stalks and leaves of withered and good canes. The general conclusion is that the cane had withered as a result of the toxic effects of magnesium present in the soil. The possible effects of other factors such as the accumulation of sodium or chlorine receive little attention while the samples of cane and soil which are used for comparison appear to have been collected from different fields at different times. A further report appears in the Agric. Journal, British Guiana, Vol. III., pp. 176-178, and describes the effect of dressing each of four stools with one half pound of epsom salt. This investigation would have carried greater weight had adjacent stools been treated with equivalent quantities of other salts such as sodium chloride, sulphate and carbonate. It cannot be said that the evidence adduced in either of these two reports conclusively proves that "root disease" is a manifestation of magnesium toxicity.

21. Certain field observations regarding "root disease" have been recorded. It is more prevalent in Berbice and is hardly ever noticed in West Demerara. Examples of it are usually confined to the dam beds. Some cane varieties are more susceptible than others. The "disease" manifests itself with the first heavy showers following a pronounced droughty period. It disappears when the affected area is irrigated.

22. The Division has made a contribution toward the solution of this problem. During the period under review plots of the seedling D 602/22, a susceptible variety, in a field trial at Sophia, exhibited symptoms which were pronounced by the Government Mycologist to be identical with those ascribed to "magnesium toxicity." These first shoots were some three feet high and it was possible to obtain from one plot of one twentieth of an acre in size five normal plants and five "diseased" plants. These ten plants were separately analysed by the Assistant Chemist.

The results obtained were examined statistically and the mean values of the two groups of five plants appear in Table X.

TABLE X.
MINERAL CONSTITUENTS OF CANE PLANTS STATED AS A PERCENTAGE OF THE ASH.

	Healthy canes.	'Diseased' canes.	't' values.	Odds in favour.
Iron oxide, etc. (Fe_2O_3 etc.)	5.21	4.57	0.548	
Lime (CaO)	3.17	3.41	0.396	
Magnesia (MgO)	6.36	5.46	0.621	
Soda (Na_2O)	0.504	0.348	0.836	
Potash (K_2O)	23.26	35.00	1.860	10 : 1
Sulphate (SO_3)	6.78	6.57	0.184	
Chlorine (Cl)	10.83	15.75	3.250	50 : 1
Phosphate (P_2O_5)	5.68	5.91	0.363	
Silica (SiO_2)	25.15	21.57	0.746	

The results indicate very definitely (odds in favour 50 : 1) that the "diseased" canes contained more chlorine than the healthy ones. They also suggest (odds in favour 10 : 1) that the "diseased" canes contain more potash than the healthy canes. This is not an unreasonable finding for Prinsen Geerligs showed in 1905 (International Sugar Journal, Vol. VII., p. 572) that a cane plant grown in soil containing large amounts of sodium chloride did not absorb any large amounts of soda but increased its uptake of potash. The salts in the subsoil waters at Sophia Experiment Station consists mainly of sodium chloride (*vide* Rept. Chemical Division for 1931, p. 74). The figures certainly do *not* indicate a greater accumulation of magnesia or a more unfavourable lime : magnesia ratio in the unhealthy plants.

23. The position regarding investigations of the effect of soil salinity upon the growth of cane may be summarized in the following manner. The possible effect of soil salinity on cane growth in this colony was early recognized and determinations of the salt content of subsoil waters were made in the year 1845. In the first two decades of the present century Sir John Harrison, as a result of a considerable amount of laboratory investigation, pointed out that the large accumulations of sodium and magnesium salts in the subsoil waters of the cane lands doubtless had a deleterious effect on cane growth and were probably responsible for the withering and scorching of canes noted at certain time in certain districts. At a later stage Mr. M. Bird attempted to prove that this withering and scorching of canes was a manifestation of magnesium toxicity due to an unfavourable ratio of lime to magnesia in the soil. Careful work recently undertaken by the Division indicates that canes showing all the symptoms of this so-called "Magnesium toxicity" contain more chlorine than do adjacent plants in a healthy condition. It seems wise, therefore, to regard this "disease" of cane as the result of the presence in the soil or subsoil of harmful amounts of soluble salts usually composed of sodium and magnesium chlorides and sulphates. In short the "disease" is a manifestation of soil salinity. It should be remembered that the "disease" is chiefly confined to Berbice. In a previous paragraph it was noted that the subsoils of the estates of Demerara were much more saline than those of the East or West Coasts of the colony. Improvement of subsoil drainage, increase of the depth of tillage and the practice of flooding-fallowing are all methods which should tend to reduce the incidence of this "disease."

CANE GROWTH EXPERIMENT.

24. During the year a detailed investigation of the growth of sugar-cane was commenced in collaboration with the Sugar-Cane Agronomist. The experiment was initiated in February, 1933, and will be completed in the first half of 1934. It compares the effect of applications of sulphate of ammonia at planting, three weeks after, six weeks after, nine weeks and twelve weeks after planting. Periodic measurements of growth increment, tiller production and water-table depth, were made while regular determinations of the moisture content, reaction, salinity, ammonia

and nitrate content of the topsoil and subsoil were effected. A complete description of the results obtained will form the subject of a separate publication when the experiment is concluded. Several interesting points arising from the existing data are worthy of mention. The rate of growth of cane appears to be intimately connected with the moisture content of the soil and the water-table depth. It was greatest when the water-table level was within five inches of the crown of the bed. When the water-table level receded and the soil moisture content decreased the rate of growth diminished. The nitrate content of the soil showed little fluctuation and remained at a low value (3 p.p.m.) throughout the season. If nitrification took place to any extent the plant apparently absorbed the nitrate immediately. The ammonia content of the soil fluctuated considerably. The subsoil usually contained more ammonia than the topsoil though, with the advent of rains following a period of drought, the ammonia content of the topsoil approached or exceeded that of the subsoil. The soluble salt content of the topsoil was remarkably uniform. The soluble salt content of the subsoil was higher during dry periods than during periods of rainy weather. The reaction (pH) of the topsoil and subsoil varied considerably during the period. Marked differences in the reaction of the topsoil and subsoil were apparent during dry weather. One point, interesting in connection with the "disease" mentioned in the previous paragraph, is brought out by a study of the reaction values for the subsoil. It has been noted that the "disease" occurs with the first heavy showers following a droughty period. During September and the first half of October the experimental area experienced dry weather. Rain began to fall during the last week of October and from that date the soil moisture rapidly increased. The reaction of the subsoil fluctuated violently during this period. During the first fortnight of the rains the normal pH dropped from 7.0 to the low value of pH 6.6. During the next three weeks the normal pH rose sharply to the high value pH 7.6. This sharp rise in reaction actually coincided with a pronounced drop in the soluble salt content of the subsoil. It is proposed to collect soil samples periodically in other areas during the transition from dry season to wet season in the hope of repeating the above observation. It is possible that this reaction change in the subsoil is connected with the incidence of the "disease."

SWEET POTATO SOILS.

25. In the report of the Division for 1932 (para. 73) mention was made of a manurial trial consisting of three 4 x 4 latin squares with sweet potatoes. One of the squares gave a markedly inferior yield of tubers and composite soil samples were collected from each of the squares for detailed examination. The results of laboratory examination are not given here in extended form but they include measurements of reaction, texture, carbon, nitrogen, salinity, rate of solution, available phosphate and exchangeable and water-soluble bases. The only marked difference between the soils of the three squares was concerned with their amounts of water-soluble and exchangeable potash. The values appear in Table XI.

TABLE XI.

		Yield lbs./acre marketable potatoes.	Water soluble and exchangeable potash mgm. eqs. per 100 gms.
Square I	Topsoil	504.5	0.35
	Subsoil	...	0.39
Square II	Topsoil	645	0.35
	Subsoil	...	0.39
Square III	Topsoil	196	0.19
	Subsoil	...	0.27

It is possible that the soil of square III. would have responded to dressings of potassic manures. In a previous experiment potassic manures had no effect on the yield of potatoes on an area containing 0.43 mgm. eqs./100 gms. of exchangeable and water-soluble potash.

MANURIAL TRIALS.

Sugar Cane.

26. A detailed statement of the manurial trials with sugar-cane reaped during 1931-32 appears in Sugar Bulletin No. I. The results of trials reaped during the first half of the year under review are to be found in Sugar Bulletin No. II. The five manurial trials reaped during the last half of 1933 are listed in Table XII.

TABLE XII.

Estate.	Field No.	Object of Experiment.
Titvragt	37 East	Optimum dose of nitrogen.
Titvragt	94 Met-en-Meerzorg	Optimum dose of nitrogen.
Sophia	13 West	Optimum dose of limestone.
Titvragt	75 Zeeburg	Optimum dose of lime or limestone.
Sophia	5, 7 and 8 West	Survey manurial trial.

The results of these experiments will be published in a further bulletin appearing during 1934.

27. The completion of the detailed soil survey of a number of sugar-estates has made it possible to devise a scheme of manurial trials with sugar-cane which should cover the points of major interest to the industry. Grants from the Imperial Chemical Industries and Messrs. Booker Bros., McConnell & Co., Ltd., have made the realisation of this scheme possible. The scheme consists of the establishment of small latin squares containing similar treatments upon a number of estates distributed throughout the coastal strip. The most important question concerning the manuring of sugar-cane is the size of the most economic application of sulphate of ammonia. Eleven experiments connected with this question were established during the year. Six of these experiments are situated on pegassy soil, three being on flood-fallowed pegasse and three being on unflooded pegasse. The remaining five experiments have been established on flood-fallowed frontland clay soil. The phosphate question is of next importance especially when it is remembered that 43 per cent. of the colony's sugar is produced on Berbice estates where soils are generally deficient in supplies of available phosphate. One chain of three experiments is concerned with the best source of phosphate and they include equivalent dressings of superphosphate, basic slag, Niciphos and Preciphos. The other chain, which is shortly to be established, deals with the economic aspects of phosphatic manuring.

28. Two of the eleven quantitative nitrogen trials were reaped as plant canes during the period under review. Both trials were situated on soils of a pegassy nature having wide ratios of carbon to nitrogen. In one trial statistical examination indicated that no significant effect had been produced. In the other trial the heavier dressings of sulphate of ammonia at the rate of 6 cwt. and 8 cwt. per acre proved to be the more effective. This result confirms those obtained on another pegassy soil of wide carbon:nitrogen ratio (Sugar Bulletin No. I., pp. 57-60). In view of the high acidity of these pegasse soils such heavy dressings of sulphate of ammonia should be accompanied by applications of lime-bearing materials. It is possible that dressings of nitrogen of this magnitude would prove of greater economic benefit if given in the form of Nitro-chalk or calcium cyanamide.

Padi.

29. Manurial experiments with padi, designed in collaboration with the Plant Breeder, have been carried out by this officer and the detailed results will be found in his report. It has been pointed out (Rept. Chemical Division 1932, para. 63) that although the yields of padi at the experiment station have gradually diminished for a number of years yet the application of manures in the ordinary manner has brought about very small yield increases which did not prove economic. In continuing the investigation two experiments were executed. The objects of the

first trial were to measure the effect of sulphate of ammonia and of superphosphate, singly and in combination upon the yield of padi and to estimate the effect of different planting distances, in the presence of fertilisers upon the yield of padi. The second experiment was designed to compare the effects of an ordinary field dressing of Niciphos with the effect of single and double dressings of Niciphos in the nursery and the effect of dipping the roots of the seedlings in a paste of bone meal at the time of transplanting.

The results of the first experiment showed that both sulphate of ammonia and superphosphate when applied singly gave definite increases in yield. With the present price of padi these gains were unremunerative. The results also indicated that although these two manures gave increases when applied separately yet when they were applied together the expected increase did not materialise. Complicated interactions between the two manures at different spacings were also noted. The usual planting distance at the Station is 8 x 8 inches and without manures this planting distance gave a yield of 17.40 bags (140 lbs.) per acre. The highest yield obtained was at close spacing with an application of sulphate of ammonia and amounted to 22.06 bags per acre. Even this increase did not cover the cost of the fertiliser. It was suggested in the previous annual report of the Division that it would prove unprofitable to manure any area which gave a yield of 18 or more bags of padi per acre. The results of this experiment tend to confirm this suggestion.

The results obtained in the second experiment indicate that ordinary field manuring gave a definite increase in the yield. The practice of dipping the seedlings in a paste of bone meal at the time of transplanting also gave a definite increase in yield. In neither case did the value of the increased yield justify the expenditure incurred in manuring. The practice of nursery manuring had no definite effect upon the yield.

The investigations carried out during the year have failed to clarify the position with regard to the manuring of padi. It is proposed to investigate the effect of applying two doses of a comprehensive manure, the one at transplanting, the other at flowering time. It is hoped in future to examine the response of different varieties of padi to applications of fertilisers.

Pineapples.

30. A preliminary manurial trial with pineapples were reaped for the first time during the period under review. The trial was carried out with the Agricultural Superintendent, West Demerara, on the concessions of a local company and its primary object was the demonstration of the necessity for fertiliser dressings. The company were not at first impressed with the need for applications of artificial manures and the delay thus caused made certain amendments to the original experimental scheme necessary. Although the trial differed considerably from that intended in the first place by the Department yet the principal object was attained.

The treatments consisted of :—

- (a) 11 lbs. sulphate of ammonia, 9 lbs. sulphate of potash, 11 lbs. superphosphate per plot.
- (b) 22 lbs. sulphate of ammonia, 18 lbs. sulphate of potash, 22 lbs. superphosphate per plot.
- (c) 33 lbs. sulphate of ammonia, 27 lbs. sulphate of potash, 33 lbs. superphosphate per plot.
- (d) 22 lbs. sulphate of ammonia, 18 lbs. sulphate of potash, 11 lbs. superphosphate per plot.
- (e) 22 lbs. sulphate of ammonia, 9 lbs. sulphate of potash, 22 lbs. superphosphate per plot.
- (f) Control, no manure.

The variety of pineapple was the Smooth Cayenne.

The layout consisted of five randomised blocks each containing six plots. The plots were approximately 1/34th acre in size and contained on the average 383 plants. The topsoil of the experimental area was typical of the concession and contained approximately 98 per cent. silica and about 2 per cent. organic matter. It was a coarse greyish-white quartz sand. The pineapples were planted in September, 1931, the fertilisers were applied in one dressing in April, 1932, and the produce was reaped from August to October, 1933. Before considering the crop results it is advisable to discuss the shortcomings of the experiment. The pines were very closely planted and it was impossible to obtain on the concession an acre of pineapples of uniform planting distance. Each plot therefore did not contain an equal number of plants, the number varying from 297 to 421. It has been necessary therefore to state the results as number of pines per 100 plants. The planting material consisted of tops imported from Hawaii and was not in particularly good condition when planted out. The fertiliser applications were originally designed to be applied in three equal doses during the period of growth. When the Company's consent to the trial was finally obtained the plants were seven months old and it was deemed advisable to apply the fertilisers in one dose. Heavy rains followed the application and it is probable that considerable quantities of the fertilisers were leached out of this light soil. In spite of these drawbacks, which had to be accepted at the commencement of the experiment, the trial has indicated the necessity for fertiliser applications to pineapples grown at the concession.

Reaping commenced in August and records were kept of the weight of each pine, the date of its collection and the particular plot from which it was obtained. In Table XIII. the yield of pines per 100 plants is given for three different dates; two of them during the early part and one towards the end of the reaping period. It is possible to draw some conclusions concerning the effect of certain of the fertiliser applications in hastening maturity.

TABLE XIII.

Fertiliser applied per acre.			Yield Pines per 100 plants.		
Sulphate of ammonia.	Sulphate of potash.	Superphosphate.	August 4.	August 23.	October 21.
373	306	373	4.6	8.6	14.7
746	612	746	4.2	6.4	16.6
1,119	913	1,119	6.7	12.2	25.8
746	612	373	11.3	17.4	28.5
746	306	746	2.8	4.8	17.6
nil	nil	nil	1.9	2.9	6.3

Statistical examination of the yield obtained to October 21 indicate that the treatments have had a definite effect on the yield; the observed "z" value is 1.1183 while the required "z" value ($P=0.01$) is 0.7508. The significant difference of the treatment means is 8.5 pines per 100 plants.

It appears that the balance of the three fertiliser constituents is of considerable importance. Taking into consideration the cost of materials, treatment D (\$42 per acre) appears to be the most promising dressing. Apart from the actual yields obtained it appears that treatment D hastened ripening while treatment E retarded ripening. The indications from the experiment are that the crop requires a high potash-low phosphate dressing. The dressings had no effect upon the average weight of the pineapples reaped.

While the experiment may be criticised in some respects yet it has served a very useful purpose. The company are now aware of the fact that they can increase their yield by at least four and a half times as a consequence of manurial treatment and are consequently more inclined to co-operate in further manurial trials. The results obtained have indicated approximately the desired balance of nutrients and will assist in the design of further trials. One such trial has already been com-

menced and is designed to compare the effects of an early dressings of slowly available nutrients such as cotton seed meal and ground rock phosphate with those obtained by applications of manures at the flowering and the fruiting stages.

OTHER INVESTIGATIONAL WORK.

Mineral Constituents of Fodder Crops.

31. Numerous samples of fodder have been examined for their mineral constituents by the Division at various times and the results have been compared with those obtained by the analysis of British pasture grasses. Such comparison indicates that most of the samples are deficient in desirable mineral constituents. In order to obtain some indication of the amounts of mineral constituents present in fodder which undoubtedly proves beneficial to cattle an experiment has been initiated in collaboration with the Government Veterinary Surgeon and the Government Botanist. Monthly samples of pasturage eaten by cattle are submitted to the Botanist for identification and to this Division for analysis. At the same time notes are kept of the appearance of the cattle. The trial is of a preliminary nature and while it is possible that the mineral content of the pasturage will not be correlated with the appearance of the stock yet the experiment should give an indication of the changes in mineral constituents of the pasturage during the course of a year. The trial was commenced during the latter part of the year and the results will be discussed in a later report.

Eight samples of forage crops grown on the frontland clays of the colony have been examined and the results are compared in Table XIV. with the figures given for British natural pasturage.

TABLE XIV.
PER CENT. OVEN DRY WEIGHT.

	A	B	C	D	E	F	G
Total Ash	6.49	7.65	6.47	9.53	6.56	10.36	...
Silica-free ash	4.87	5.06	6.20	8.87	4.67	5.23	5.85
Silica (SiO ₂)	1.62	2.59	0.27	0.66	1.89	5.13	...
Sulphate (SO ₃)	...	...	...	...	...	0.67	...
Chloride (Cl)	0.79	0.54	0.97	0.38	0.88	0.60	0.64
Phosphate (P ₂ O ₅)	0.55	0.47	0.55	0.82	0.76	0.48	0.67
Nitrogen	3.36	3.15	2.08	2.78	1.15	1.22	2.50
Lime (CaO)	1.15	0.85	0.94	1.53	0.28	0.48	0.65
Magnesia (MgO)	1.14	0.97	0.90	0.48	0.47	0.65	...
Potash (K ₂ O)	...	...	1.99	3.63	2.08	1.29	2.66
Soda (Na ₂ O)	0.29	0.46	0.18	0.08	0.24	0.14	0.37
Iron oxide (Fe ₂ O ₃)	...	...	0.22	0.51	0.22	0.24	...

- A. Horse Weed (*Alysicarpus vaginalis*). From Kitty, E. Coast, Demerara.
 B. Dove Weed (*Desmodium barbatum*). From Kitty, E. Coast, Demerara.
 C. *Phaseolus semi-erectus*. From Government Stock Farm.
 D. *Phaseolus semi-erectus*. From Anna Regina, Essequibo.
 E. Uba Cane leaves. From Government Stock Farm.
 F. Mean of three monthly samples of mixed pasturage from Government Stock Farm.
 G. British natural pasturage (All grazed).

32. The fodder crops of the coastlands of British Guiana are usually somewhat deficient in phosphate and lime. These deficiencies are not so marked in the samples under review. The samples of *Phaseolus* from Essequibo and the sample of Uba cane leaves are well supplied with this constituent, the other four samples are somewhat deficient. The leguminous crops are well supplied with lime but the samples of mixed pasturage and of Uba cane are deficient in this respect.

33. Two samples of pasturage obtained by Government Officers from the intermediate savannahs have been examined. One sample was collected from Mr. Evan Wong's ranch, Berbice River, by the Government Veterinary Surgeon; the other was obtained by the Government Botanist during his visit to Yawakuri on the Berbice Savannahs. It consisted of

"green shoots of *Trachypogon plumosus*, gathered near the soil sampling pit where cattle had just been grazing. Only the tops of the shoots were taken part being pulled and part being cut with a knife. For practical purposes, this is the only grass on this portion of the Savannah. Elsewhere a little *Axonopus aureus* was found too, but only scattered."

The results of analysis of the two samples of grass are compared in Table XV. with the British natural all-grazed pasturage.

TABLE XV.

	Yawakuri.	Berbice River.	British.
Total ash	5.49	8.43	...
Silica free ash	1.43	2.07	5.85
Silica	4.06	6.36	...
Phosphate	0.09	0.12	0.67
Lime	0.14	0.09	0.65
Magnesia	0.26	...	...
Potash	0.55	...	2.66
Soda	0.10	...	0.37
Nitrogen	1.19	0.76	2.50

Like all other samples of grass obtained from the interior both of these samples are very deficient in supplies of phosphate and lime. Soil samples collected at Yawakuri indicate that the are consists of a slightly acidic sand from which practically all the plant food elements have been leached. It is not surprising that this soil supports a cover which is deficient in every mineral investigated.

Pineapples.

34. In addition to the experimental work with fertilisers already discussed a considerable amount of investigational work with the fresh fruit and the products of the recently erected pineapple canning plant has been undertaken by the Division. This work included the analysis of canned pineapple, fresh pines, sugar, crude vinegar, tin-plate, boiler-feed water and fertilisers and the inspection and adjustment of specific gravity balances.

A series of cans of sliced pineapple from other sources was analysed for comparison with the company's product. The results appear in Table XVI.

TABLE XVI.

Can No.	1	2	3	4	5	6	7
Taste, acidity ¹	-1	+1	+2	-1	0	-2	+2
sweetness ¹	+1	+1	-1	+1	0	-2	0
Acidity c.c.s. ²	10.0	7.5	17.2	8.5	7.5	6.5	18.8
pH	3.53	3.37	3.37	3.71	4.12	3.78	3.8
Brix	26.3	24.7	23.7	24.8	25.9	17.6	25.7
Per cent. Citric acid	0.64	0.48	1.10	0.54	0.48	0.42	1.20
Brix/Citric acid	41.1	59.7	21.6	45.9	54.0	41.9	21.4

¹Arbitrary classifications. ²C.C.S. N10 alkali neutralised by 10 c.c.s. of syrup.

The classification made by members of the staff favoured Can No. 5, a sample of low acidity and relatively high pH value. Considering, however, all samples it would appear that a syrup pH of about 3.5 is required. The final brix value depends on the product being manufactured and on the requirements of the market.

35. When the factory commenced operations only small amounts of fruit from imported planting material were available and fruit of local origin was employed.

Mean figures obtained by the examination of several of these cans appear in Table XVII.

TABLE XVII.

Acidity ccs.	...	...	2.9
pH.	...	...	4.0
Brix	...	...	22.7
% Citric acid	...	...	0.188
Brix/citric acid	...	...	120.8

It will be seen that local fruit does not contain the requisite amount of acid for canning purposes. This point is considered in more detail in the following paragraph:—

During the first period of operation a certain number of fruit obtained from imported plant material and also local pineapples were examined. The mean results of analyses of a number of juices from these fresh fruits are shown in Table XVIII. These fruits were obtained during the months of May, June and July.

TABLE XVIII.

Variety.	Smooth Cayenne.	Red Spanish.	Local.
Acidity ccs.	10.8	12.6	7.8
pH	3.8	3.5	4.0
Brix	14.5	13.1	16.2
Per cent. Citric acid	0.691	0.808	0.499
Brix/citric acid	21.0	16.2	32.4

It will be seen that the first batch of fruit, especially that of local origin, was low in acidity. Blair and Wilson (Bull. 101, Fla. Agric. Exp. Stat. 1910) give the mean percentage of citric acid in the juice of Red Spanish pineapples as 0.98. The authors state that the amount of sugar and acid in the juice does not appear to be affected by the *kind* of fertiliser used. Their results do not include figures from unfertilised plots and therefore do not indicate whether fertilised pineapples contain more acid and sugar than unfertilised fruit. They suggest, however, that an increase in the amount of fertiliser very slightly decreases the acid content and slightly increases the sugar content. Analyses of further periodic samples of fruit and the examination of pineapples from the different plots of the second manual experiment should clarify the position.

The acidity of the juice of locally grown Smooth Cayenne pines is compared in Table XIX. with the results reported for the same variety grown in other countries.

TABLE XIX.

		Acidity as citric acid per cent.
British Guiana, first batch	...	0.69
British Guiana, second batch	...	0.97
Florida	...	0.85*
Hawaii	...	1.05*
Philippines	...	0.70*

It will be seen that, while the first batch of locally grown Smooth Cayenne pineapples were somewhat deficient in acidity, subsequent collections compared very favourably in this respect with the fruit of other countries.

36. Shortly after factory operations were commenced it was noted that a certain proportion of the tins possessed a blackened interior. The blackening appeared to be due to the presence of sulphur in the contents. Samples of the sugar used for preparing the syrup did not contain more than traces of sulphur. It is possible

*Wells *et al.* Philippine Journal of Science 56 157-186.

that the sulphur present in the cans was derived from insecticidal sprays with which the fruit had been treated. Various samples of tin-plate were examined in this connection.

A number of samples of boilerfeed water were analysed and suggestions were offered for its clarification. Apparatus destined for the chemical control of the factory has been examined. Samples of crude pineapple vinegar have been tested and suggestions for its clarification have been made. During the first period of factory operation the services of the Laboratory Assistant, Mr. L. A. Robinson, were loaned to the company for the purposes of chemical control. Mr. Robinson submitted, on his return, an interesting report describing some preliminary work on the changes in composition of different varieties of pineapples at various stages of maturity. It is hoped to extend work in this direction in the future.

The Composition of Local Honey.

37. During the period under review fifteen samples of local honey were examined. The results appear in Table XX. where the samples are roughly arranged in order of colour, lightest at the top and darkest at the bottom.

TABLE XX.

Sample.	Per cent. Total Sugars.	Per cent. Sucrose.	Per cent. Reducing Sugars.	pH.
1	80.7	11.3	69.4	3.93
2	78.7	12.9	65.8	4.00
3	72.7	6.0	66.7	4.63
4	81.5	10.1	71.4	3.97
5	72.0	7.5	64.5	4.25
6	75.4	6.4	69.0	4.35
7	78.9	9.5	69.4	4.17
8	70.8	1.4	69.4	4.30
9	68.9	1.3	67.6	4.40
10	82.3	19.0	63.3	4.28
11	74.3	5.8	68.5	4.43
12	75.8	9.1	66.7	4.23
13	72.2	4.2	63.0	4.10
14	74.8	7.2	67.6	4.17
15	77.1	18.3	58.8	4.27
Mean	75.8	8.67	67.1	4.23

The mean sucrose content of the samples of local honey is 8.67% which is considerably higher than the values reported by Browne (Handbook of Sugar Analysis) for European honeys (1.76%) and American honeys (1.90%). It is possible that the large proportion of sucrose in these honeys is due to their immaturity or may possibly be due to bees feeding on available supplies of sugar in factories or upon the wharves. With such high proportions of sucrose about fifty per cent. of the samples would prove unacceptable in foreign markets. There appears to be no obvious connection between the colour of the samples and the proximity of the hives to sugar factories. Recent work (Paine, Gertler and Lottrup, Ind. Eng. Chem., 26, pp. 3—81) suggests that darker honeys usually contain larger amount of amino-nitrogen. It is hoped to continue the investigation of local honeys in the future.

Cassava Flour.

38. Several samples of cassava flour have been examined as regards their acidity, moisture content and degree of subdivision. The moisture content varied between twelve and fourteen per cent. The acidity of the samples varied considerably, four of the samples contained less than 0.1 per cent. of acid while one sample contained 0.41 per cent. acid. There was also considerable variation in the degree of subdivision. 12.3 per cent. of the coarsest sample remained on a 100 mesh sieve while 0.8 per cent. of the finest sample remained on a 100 mesh sieve.

Occurrence of Marl in the Rupununi District.

39. From time to time the District Commissioner of the Rupununi has submitted samples of minerals collected during his tours. One sample examined during the year gave the following approximate analysis.

TABLE XXI.

	Per cent. air dry basis.
Silica ...	... 16.5
Iron oxide, alumina, etc. ...	... 10
Lime ...	... 38
Carbon dioxide ...	... 27

The Commissioner stated that this material formed the bed of a creek about 800 yards above Bon Success, Takatu River, Rupununi Savannah.

The substance is marl and if deposits of this material are extensive then the matter is one of considerable importance to the Rupununi. The samples of pasturage collected in this district and submitted to the Division (Ann. Rept. Chem. Div. Dept. Agric. 1931, para. 29) contain very small amounts of lime. If deposits of marl are available this deficiency of lime may be corrected with beneficial effects on the livestock. Attempts are being made to define the extent of this deposit.

ACKNOWLEDGEMENTS.

40. It is with great pleasure that I acknowledge the very considerable help rendered during the year by my colleagues, Mr. C. L. C. Bourne and Mr. L. A. Robinson.

R. R. FOLLETT-SMITH,
Chemist-Ecologist.

February 23, 1934.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE BOTANICAL AND MYCOLOGICAL DIVISION FOR
THE YEAR 1933.

DISEASES OF MAJOR CROPS			...	...	...	PAGE.
Sugar Cane; Rice; Coffee; Coconuts; Citrus; Cacao.						105
DISEASES OF MINOR CROPS			...	...	...	107
Pineapples; Tomatoes; Tobacco; Cow Pea; Roses; Malachra capitata; Guinea grass; Guatemala grass; Miscellaneous.						
BOTANICAL INVESTIGATIONS			...	...	...	108
Rice Grass; Citrus; Fish Poisons; Flood-fallowing of Cane Fields.						
JENMAN HERBARIUM			...	...	...	110

REPORT OF THE BOTANICAL AND MYCOLOGICAL DIVISION FOR THE YEAR 1933.

STAFF.

E. B. Martyn, B.A.—Botanist and Mycologist.
N. Persaud —Laboratory Assistant.

DISEASES OF MAJOR CROPS.

Sugar Cane.

No noteworthy disease of this crop was reported or observed during the year. With regard to Root disease, or withering of cane, it is proposed that in future the withering of cane, referred to hitherto as root disease, shall be called "Salt Blight," to indicate its direct relationship to the salt constituents of the soil. One of the larger estates in the Corentyne District, Berbice, where the disease usually makes itself apparent to a greater or less degree every year, has installed a floating pump and sprinkling apparatus whereby the dam beds can be watered during dry weather. It will be of interest to note the effect upon the disease of this more efficient method of irrigating the dam beds upon which the disease is generally more prominent than elsewhere in the fields.

2. During July a mottled appearance of some B.H. 10 (12) was reported from the same estate in Berbice, other varieties in the same field remaining unaffected. It was apparently a similar appearance to that which has been noted on this variety of cane, and attributable to conditions of growth. A few weeks later the cane was reported as improved in appearance.

3. Towards the end of the previous year, during the dry season young ratoons of D.602/22 in a variety trial at Sophia Experiment Station were seen to be badly affected by symptoms similar to those of root disease. So marked were the symptoms that the plots of this variety could be seen from the edge of the fields as a series of brownish patches. The dry weather had come soon after cutting, and this variety would seem especially susceptible to drought. At the beginning of the year, however, after a month of rain, the field was visited again, and the plots of D.602 appeared perfectly healthy, comparing favourably with any other cane in the trial, and better than some. A few dead leaves at the base of the stools were the only remaining traces of their earlier withered appearance.

4. During the dry weather, samples of withered and green canes were selected for analysis; the matter is discussed in the Chemist's report. It was found that the withered shoots contained a definitely higher percentage of chlorine than the green, but that the amount of magnesium varied little between the two. The results tend to confirm the view that these symptoms are due to an excess of soluble salts of any nature in the soil, rather than supporting the idea previously put forward that the disease is due to the presence of excessive amounts of magnesium in the soil. It is proposed in future to use the term "Salt Blight" in referring to this withering of cane, which has hitherto been called "Root Disease."

Rice.

5. This crop has not been affected by any disease of a serious nature during the period under review. Comparative cultures have been made of the *Fusarium* isolated from plants affected by "Man Rice," and that responsible for the similar disease of rice occurring in Madras, which has been referred to in reports of former years. A culture of this latter fungus was obtained from the Imperial Mycological Institute by whom both fungi have been determined as variations of *F. moniliforme* Sh. The two fungi are very similar as regards their spore measurements, and colour reactions upon Rice

Media. Infection experiments with inoculated soil showed the Indian strain to be rather more virulent. The effect of both strains on rice seedlings grown in pots were more marked when the growth took place with the soil surface in the pots above water level, than when the soil was submerged as in a normal rice field. It is of interest to note that inoculation of five months old ratoons of P.O.J. 2878 cane with the *Fusarium* isolated from "Man Rice" plants, produced on one or two leaves symptoms identical with those described and figured for Pokkah. The inoculations were carried out by injection of a spore suspension with a hypodermic syringe in the neighbourhood of the growing point.

Coffee.

6. *Sclerotium Disease*.—A serious outbreak of this disease occurred on one grant on the Aruka River, N.W.D., but the disease was nowhere else reported as extensive. This disease it may be noted usually makes its first appearance on trees when they are about five or six years old.

7. *Phloem necrosis*.—Investigations made on the occurrence of this disease in the North West District point to the age of the trees, and the care with which they have been managed, as being the main factors concerned in its appearance. Trees of 16 years of age and upwards are in particular prone to the disease, which sometimes attacks isolated trees, weakened perhaps by some factor in their particular situation, whilst in other cases, whole blocks of trees are affected. The bad outbreak which occurred on one grant in 1932 (Ref. para. 11 of the 1932 report) began with the onset of a spell of dry weather, in September, affecting trees of over 16 years of age. The death of trees on a large scale (the total loss was approximately 37 per cent.) continued throughout the dry weather, till the rains began again in December, when it ceased, and has not recurred to the same extent since. It is to be noted that in nearly every case in which trees have died, seedlings from fallen berries have sprung up around the base of the dead parent tree. Some of the oldest of these seedlings, all of which appear vigorous, are already bearing.

8. As a practical measure, therefore, it would appear advisable to cut out the dead trees, and allow the most vigorous of the seedlings to replace them. The resulting trees, with normal attention to cultivation, should remain unaffected by the disease, and bear for some years at any rate. Ultimately of course the pegasse will become exhausted and will have to be abandoned, but the loss of even a number of trees on areas which have had, as in this case, perforce to be somewhat neglected, does not necessarily indicate that such areas are not still capable of yielding a reasonable return with proper care. The whole question of care of the land and the advisability of "supplying" isolated dead and weak trees, or whole sections that have been attacked by *Phloem necrosis*, is at present affected by the low price of coffee prevailing.

Coconuts.

9. At the onset of the long wet season, a case was reported from an estate on the East Coast, Demerara, of a disease resembling bud rot. Inspection showed a few scattered three-year old trees with the outer leaves brown and wilting, the intermediate leaves more or less healthy in appearance, and the heart rotten. Cutting open the heart showed the young leaves to be affected by a soft brown rot, and the growing point and the leaf primordia to be decayed and putrefying. The symptoms were similar to those associated with Wilt disease of coconuts, but differed in that the heart and youngest leaves had become affected while some of the intermediate and outer leaves were still green. The disease was apparently associated with the recent onset of wet weather. The few trees affected were cut down and burnt, and it was advised that any further suspected cases be treated with an application of Bordeaux mixture to the heart of the tree. No subsequent continuance of the disease was reported.

Citrus.

10. *Scab Disease (Sporotrichum citri* Butler).—A bad outbreak of this disease occurred in the midyear on Seville orange seedlings at the citrus nursery at Hosororo, N.W.D. As the disease was not hitherto recorded for the Colony, it is possible that it was introduced on budwood received from Trinidad. Regular spraying with Bordeaux mixture was carried out, together with the destruction of affected Seville orange seedlings, and by the end of the year the disease appeared to have been stamped out. Fortunately the outbreak occurred in a small area some distance away from the citrus orchard at the station. As a further precaution against the spread of the disease all budded citrus plants sent from the North West District to Georgetown were sprayed before despatch, and kept in quarantine on arrival.

11. *Galls*.—On some old seedling orange trees on an estate on the East Bank small woody galls were found occurring here and there on the trunks and branches of the trees. They did not appear to be caused by any external organism.

Cacao.

12. A leaflet on the Witch Broom disease was prepared and circulated in the North West District. The disease has not yet been recorded in this district and it is hoped that by taking suitable precautions its appearance there may be avoided.

DISEASES OF MINOR CROPS.

Pineapples.

13. Black Eye disease or "browning" occurred again at the New Pineapple Company's cultivations on the Demerara River, but to a less extent than last year. A count made on one day during the reaping in the middle of the year showed an average of about 40% of the Smooth Cayenne fruits coming into the factory to be "browned," and 25% of the Red Spanish. These fruits were, however, still able to be used for jam, "chunks," etc. About 4% of the Smooth Cayenne fruits and 14% of the Red Spanish fruits examined were so "browned" as to be useless. It was reported that towards the end of the year very little "browning" was to be seen. It is important, however, that more accurate figures be obtained as to the exact extent of "browning" and the amount of loss for which it is responsible, and it has been suggested to the Company that regular counts be made in future when harvesting and canning are in progress.

Tomatoes.

14. Tomato Wilt (*Fusarium lycopersici*) was observed in the vegetable garden at Queen's College.

15. *Mosaic Disease* was observed on a number of varieties grown at Whim sub-station on the Corentyne Coast. The affected plants showed the "fern leaf" type of leaf distortion. "Early Market" appeared rather less affected than "Marglobe." All varieties had set fruit before the disease became apparent.

16. *Sclerotium rolfsii* was observed attacking the "collar" of a wilted tomato plant at sub-station Cecilia.

17. Root knot—*Heteroderae radiculicola*—one apparent case of this disease was found affecting a tomato plant at Sub-station Cecilia.

Tobacco.

18. *Wilting*.—A wilt of tobacco plants was observed on a small plot on the West Bank. Scattered plants suddenly wilted, and on digging up the roots were found to be discoloured. No organism was discovered to which the disease could be directly ascribed.

Cow Pea.

19. *Mosaic Disease* was observed upon cow peas grown at sub-station Cecilia.

Roses.

20. Rose Mildew (*Sphaerotheca pannosa* (Wallr. Lev.) was observed upon some new rose plants recently introduced from England and cultivated at Government House. The affected plants were dusted with sulphur and lime.

Malachra Capitata.

21. A powdery mildew was found upon the leaves of this fibre plant at sub-station Cecilia, where a little of it is cultivated.

Guatemala Grass.

22. A chlorotic and crumpled appearance of part of the leaves was noted on plants of this grass (*Tripsacum laxum*) at the Experiment Station. The symptoms were apparently due to a temporary constriction as the young leaves emerged, and seems comparable to "Tangle top" of sugar cane.

Guinea Grass.

23. A leaf spot occurred on this grass (*Panicum maximum*) at the Experiment Station, associated with *Cercospora* sp.

Miscellaneous.

24. The preliminary list of diseases of economic plants in the Colony, mentioned in last year's report, was published in the Kew Bulletin, and a number of reprints of the list were sent to the Colony for distribution locally and abroad. Copies were also distributed by the Imperial Mycological Institute.

25. Thanks are again due to the Institute for determinations of specimens forwarded to them, and for advice and assistance given concerning matters referred to them.

BOTANICAL INVESTIGATIONS.**Rice Grass.**

26. Observations have been continued upon the experimental plantings of *Spartina Townsendii* and upon the development of the vegetation of the foreshore east of Georgetown. The amazingly rapid spread of the local Rice Grass (*Spartina brasiliensis*) followed shortly after by Courida (*Avicennia nitida*) and White Mangrove (*Laguncularia racemosa*) and the very quick growth of the two latter, become increasingly noticeable. In August the first scattered plants of *S. brasiliensis* were observed on the mud bank which has been forming of recent years west of Kitty jetty.

It has become apparent during the past year that *S. townsendii* is unable to compete with *S. brasiliensis*, which dominates it when the two grasses come into competition and which is itself dominated later by Courida and White Mangrove.

Citrus.

27. The Experiment Stations in the North West District were visited during the year, and a report submitted, together with recommendations on the scope of the stations.

28. Visits were paid to a number of citrus growers. One farmer on the Berbice River, who started his own citrus nursery, with the assistance of the Department during the year carried out budding which proved most successful.

Fish Poisons.

29. A report was received early in the year from Rothamsted on the analysis of samples of Black and White Haiari, including young plants from the experimental cultivation in the North West District and older plants from the forest. The results, judged by the percentage of rotenone in the plants, were disappointing. The highest concentration was found to occur in the roots of the plants, and in only one

case, that of a mature plant from the forest, was the quantity found to approach the minimum percentage (3%) considered necessary for the commercial exploitation of similar poison plants elsewhere. On the other hand, while some authorities base the toxicity of poison plants on rotenone content, others judge by the ether extract of other poisonous constituents, and the relative effectiveness of the two is still somewhat obscure. It is possible that judged by the ether extract the Haiari samples would have shown up more favourably, and that their toxicity value may still fulfil the promise shown by earlier trials.

30. The root system of the Haiari plants is in no case large, and in the Black variety, which shows the higher poison content, is very poor. The cultivation in the North West District, however, is to be continued for a while to observe what results may be obtained from older plants. It has been recommended, however, that it be confined to the open plots on sandy soil at Wauna, where the growth of the plants is considerably more vigorous than on the other experimental plots, (*i.e.*, on laterite soil at Hosororo and under shade).

31. It is possible that in former consignments sent for analysis a part of the rotenone may have broken down during transit, and in future steps will be taken to ensure thorough drying of the material immediately after gathering, which preserves the rotenone content for a longer period. It is probable also that different strains of Haiari exist with varying degrees of potency. Such variations appear to be recognised by the Indians, but are extremely difficult to classify and recognise botanically. New strains may be discovered, which yield more promising results, but it will then remain to be seen whether they will retain their higher percentage of poison content under conditions of cultivation and vegetative propagation.

Flood Fallowing of Cane Fields.

32. Experiments are being carried out by the Chemist and the Agronomist on two sugar estates on flood fallowing, one series of plots being subjected to flooding at various depths while another series were flooded for different periods. One aspect of this work to be followed up was the effect of the aquatic flora, which develops in the flooded fields to an extent varying with the depth of flooding, and accordingly observations were made on flora of the experimental plots.

33. The treatments of the flooded plots were as follows:—

A.—completely flooded for six months (1 ft. 6 ins. over highest parts).

B.—completely flooded for six months (1 ft. 6 ins. over highest parts)
molasses added.

C.—completely flooded for six months (1 ft. 6 ins. over highest parts)
floating aquatics sown.

D.—completely flooded for six months (3 ins. over highest parts)
semi-aquatic weeds and bush
growing spontaneously.

34. Where treatment A. was effectively carried out and the depth maintained, little or no vegetation appeared on the plots, with the exception of occasional small patches of floating weed here and there due to accidental invasion or introduction from outside. In treatment B. where molasses was added, small patches of semi-aquatic grasses occurred on the shallower areas, and scattered patches of floating aquatics also occurred. The occurrence of a little vegetation on plots was principally due to accidental introduction of plant material when the molasses was being added.

35. The plots accorded treatment C. were the most striking in appearance, a thick cover forming over the whole plot, on the floating aquatics introduced. These were the common aquatics of the estate trenches, etc., including *Marsilia polycarpa*, *Neptunea oleracea*, *Pistia stratiotes*, *Hydrocleys Commersonii*, *Pontederia cordata*

Cabomba, aquatica, Eichhornia sp., *Ipomœa reptans*, *Nymphaea* spp. and *Azolla carolinæa*.

36. The usual method of introduction was simply to place a handful of the plants here and there on the surface of the water, pegging them in position to avoid the wind drifting them to one side. From these nuclei a general cover soon formed. On one plot, where *Marsilia* alone was introduced, it was found necessary to lower the water level until the plant was established, after which it was raised again.

37. The plots receiving treatment D. showed the usual appearance of cane fields flooded as part of estate practice, and where it is not always possible to maintain sufficient depth over the tops of the beds to eliminate all vegetation, and a number of semi-aquatics develop.

38. Commonest among these is *Jussieu erecta*. *Canna glauca* is prevalent on estates in the Corentyne, while *Sphenoclea zeylanica*, and in some cases *Phaseolus semi-erectus*, are found on flooded cane fields in the county of Demerara. Sedges and semi-aquatic grasses are also of course plentiful, the species varying with the depth of the water.

39. When the period of flooding was over the plots were planted to cane again, and the relative effects of the different treatments described above, will become evident when the plots are reaped.

JENMAN HERBARIUM.

40. The remounting and indexing of the specimens has been continued during the year. Determinations of plants submitted for identification and similar routine matters have been dealt with.

41. Capt. H. A. Johnstone again visited the Colony at the beginning of the year and made a further study of the palms represented in the Gardens. With his assistance, and the determination by Kew of material sent them representative of a number of palms under cultivation, the nomenclature of the specimens of this group in the Gardens was placed on a surer footing than hitherto.

42. The Herbarium is also much indebted to Capt. Johnstone for the presentation of a very fine set of photographs representative of a large number of ornamental palms cultivated in Botanic Gardens which he has visited, and elsewhere.

43. A Plant and Seed Exchange List was prepared and published during the year, and sent to various Institutions akin to the Botanic Garden. As a result, a large number of requests for seed were received, and collections were made to supply these *desiderata* as far as possible.

44. A number of specimens were forwarded to Kew during the year, for determination, and in response to requests made. The unnamed sheets of *Bignoniaceæ* in the Herbarium were despatched to be examined in connection with a special study of South American specimens of this group at present being undertaken at Kew.

45. A parcel of fern material, from a collection made some years ago on the Berbice Cattle Trail was forwarded to the Natural History Section of the British Museum for determination.

46. Determinations were received of the majority of the unnamed sheets sent to Kew last year, and unduplicated material returned. A number of specimens, however, were retained at Kew for further study. This collection of unnamed sheets from the Herbarium having yielded some very interesting specimens on examination, a further consignment of rather over 500 sheets was sent to Kew for study. A number of unlabelled and otherwise useless sheets were destroyed, and it is hoped that with the despatch of one more batch of sheets to Kew, and upon

receipt of the determinations of all this material, there will remain but few sheets in the Herbarium which are not correctly classified, at any rate as regards genus, and placed in their proper shelves. It will also largely eliminate the possibility of material placed in the Jenman Herbarium being unknown or unrepresented at Kew.

47. During the year a small party of Cambridge scientists visited the Colony, making their headquarters at the Forestry Station, Mazaruni. The Botanist, Mr. Tutin, made a very valuable collection of plants during his stay, including especially algae and some of the smaller aquatics. He spent some time in the neighbourhood of the Kaieteur Falls, which area has not been extensively examined by a Botanist since Jenman visited it in 1881.

48. In response to an enquiry received from Germany, living material of *Salvinia Radula* was obtained from the Lamaha Conservancy, at Flag Staff, where it was found in abundance, and despatched to its destination in a special tank under personal charge.

E. B. MARTYN,
Government Botanist and Mycologist.

December 30, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT ON THE BOTANIC GARDENS FOR THE YEAR 1933.

CONTENTS.

	PAGE.
GENERAL	115
FRONT GARDENS	115
Water Supply; Planting, etc.; Borders; <i>Corypha elata</i> ; Lakes; Miscellaneous.	
PARK LANDS	117
Avenue; Labels; Climbing Plants; Draft Animals; Miscellaneous.	
NURSERIES	118
Ornamental Section—Glass House; Palm House; Orchids; Roses etc.; Introductions; Solar Propagator.	
Economic Section—Citrus; Mangoes; Introductions; Oil Palms; Grafting; Miscellaneous.	
TABLES	119
CARNEGIE TRADE CENTRE	121
GOVERNMENT HOUSE AND PUBLIC BUILDINGS	122

REPORT ON THE BOTANIC GARDENS FOR THE YEAR 1953.

STAFF.

E. B. Martyn, B.A.	—Superintendent, Botanic Gardens.
H. A. Cole	—Horticultural Assistant.
G. L. Leitch	—Clerical Assistant.
M. Sheriff	—Nursery Foreman.

GENERAL.

Mr. Cole was absent on leave from February to July, Mr. Leitch acting for him during this period.

2. The year under review was noticeable for the persistent rainfall. Not only was the total (116.55 inches) considerably above the average, but rain fell almost throughout the year, and only very short dry periods were experienced.

3. The planting of shrubs and trees was continued, and both in the Avenue and the Front Garden a number of new introductions were made and gaps were filled with ornamental plants.

4. Part of the old system of pipe lines in the southern half of the flower garden was repaired, and connected to the town water supply.

5. During March the Gardens were filmed by representatives both of the Empire Marketing Board and the Metro Goldwyn Mayer Film Company.

6. An illustrated Guide to the Gardens was prepared, and will be published shortly.

7. The following table shows the amounts spent under the votes accorded to the Gardens :—

	Vote.	Expenditure.
Botanic Gardens—Maintenance ...	\$4,500 00	\$4,493 22
Purchase, Production and Distribution of seed and Citrus production ...	3,500 00	3,492 66
Government House and Public Buildings ...	1,400 00	1,393 78

FRONT GARDEN.

Water Supply.

8. The most important feature concerning this section of the Gardens was the connection of a part of the old pipe line system to the city water supply, the cost of which was borne jointly with the Chemistry Division, who early in the year moved into the house once occupied by the Superintendent.

9. The system of underground pipes was laid down in 1882 in connection with the irrigation tank and engine by the "Cow Pen." The original steam engine proved too expensive to run and was subsequently replaced by an oil engine. This too has fallen into disuse of recent years, and all watering during dry weather has been carried out by hand.

10. In 1930, the possibility of connecting the Gardens to the city mains was considered, but found to be too expensive. The old pipe system, however, was tested, and found still in order and fit for use. During the past year, by sharing the expenditure between the Gardens and the Chemistry Division, it has been possible to connect the western end of the Gardens pipe lines, near the Director's house, to the city main in New Garden Street, and also to put in order one of the old pipe lines,

which were originally laid down in the form of a grid at 100 ft. intervals. The pipe connected runs through the centre of the southern part of the flower garden, and from it a branch has been run off to the Chemistry Laboratory. On connecting up the pressure, a number of leaks and faulty sections of piping were revealed, and were put in order. Stand pipes and taps have been put in at suitable points, and it is now possible to water the greater part of the lawns, nursery bed and flower beds in the southern section by hose. Subsequently it is hoped to extend the connections to include further sections of the old system, so that the greater part of the Flower Garden and the whole of the nurseries, will be able, to be watered by hose pipe during dry weather.

Planting.

11. A variety of herbaceous plants have been maintained in the parapets and borders. In some beds the depredations of various insects which destroy the newly bedded out seedlings have been very troublesome, and have necessitated continual care and supplying, before an effective display could be obtained.

12. A red salvia proved very effective in the parapets and the addition of an edging of various types of *Coleus* in the front of the Central Avenue parapets has enhanced the appearance of these considerably. A large headed Red Cockscomb of dwarf habit was obtained early in the year, but in successive generations, the size of the head was not uniformly maintained.

13. The north western border and the border behind the western cherry hedge were edged with blue *Plumbago*, which gives a good show of flowers in the dry weather.

14. A hedge of *Hibiscus* and Barbados Pride alternated was planted along the trench connecting Nos. 1 and 2 lakes and a hedge of different *Hibiscus* varieties was established around the Director's house.

15. The *Coleus* and *Graptophyllum* in the circular beds on the Director's lawn were replaced by President Cannas and a new bed was made north west of the tennis court and edged with stones and box. In it a very good display of Pink Hollyhocks, Dahlias, "Four O'Clocks" and *Dianthus* was obtained at the end of the year—a real approach to a herbaceous border.

16. A special bed was prepared near the nursery and plants of *Vanda teres* set in it to try and induce flowering, all other methods having failed. It remains to be seen how they will fare.

17. A group of oil palms, from seed received from Java, was planted east of No. 2 lake, and a group of Betel Nut Palms north of No. 1 lake. The path south of No. 2 lake was bordered with Betel Nut Palms and *Livingstonia* sp. alternated. A large number of palms, trees and shrubs were planted out in May, including *Acanthorhiza aculeata*, *Corypha umbraculifera*, *Licuala grandis*, *Oreodoxa borinquena*, *Ptychographis augusta*, *Cassia grandis*, *Cassia multijuga*, *Cassia nodosa*, *Calliandra Guildingii*, *Enterolobium cyclocarpum*, *Erythrina corallodendron*, *Lucuma mammosa*, *Lysidice Rhodostegia*, *Macadamia ternifolia*, *Peltophorum ferrugineum*, *Plumeria acutifolia*, *Swietenia humilis*, *Tamarindus indica* and *Tabebuia Guayacan*. A number of these had been raised from seed obtained from the Trinidad Gardens, others from seed sent us by Professor Balmé of Mexico.

18. A number of ornamental plants were received from the Trinidad Gardens during the year, and of these *Mussaenda erythrophyllya*, *Beaumontia grandiflora* and *Solanum Wendlandii* have been put out, the remainder still being in the nursery. A *Bougainvillea*, var. Lady Walters, from the same source, was planted to cover an arch near the Front Office.

Borders.

19. The Lamaha border which had become very overgrown was thinned out. Behind the D'Urban Park Grandstand, the Hibiscus hedge was supplied and thickened, and the border under the trees weeded and planted with *Demerara Primrose*.

Corypha elata.

20. The specimens of this palm which flowered in 1932 matured their fruit, which began to be shed in August. The palm on the lawn in the southern section was then cut out, as the subsequent germination of the fallen seeds on the lawn would have been unsightly. The other specimens in the borders, however, were left and were still shedding fruits at the end of the year.

Lakes.

21. It has been observed for some time past that the manatees are doing considerable damage to the banks of the lakes, which are undermined and then collapse, so that in places the bank has fallen away to a depth of several feet. A start was made near the bridge where the manatees are fed, to reclaim a section of the bank by building a wooden "paal" off a short distance out and gradually filling the space between it and the bank with rubbish and earth, etc.

Miscellaneous.

22. All the benches in the Gardens were painted during the year, being given a double coat. The paths of the Meteorological Observatory were sheeted with burnt earth, and the road near the Glass House was patched.

PARK LANDS.

Avenue.

23. A heap of earth was burnt in October and the "sheeting" of the avenue continued. There now only remains some 200 yards to be completed.

24. Casualties in the avenue during the year included another of the old Oronques, this one near the Iron Bridge, and a fine specimen of *Lonchocarpus latifolius* opposite to it. Another creeper covered Oronque stump at the bottom of the Avenue fell also. A young plant of *Monodora grandiflora* put out last year unfortunately died. To replace these gaps and fill other spaces further planting was carried out, including *Calliandra Guildingii*, *Cassia* spp. *Gliricidia maculata*, *Hydnocarpus venenata*, *Kopsia fragrans*, *Lagerstroemia flos-reginae*, *Peltophorum ferrugineum*, *Swietenia humulis* and several palms. At the end of the year a number of flowering shrubs including Hibiscus, Ixora, Duranta, Petrea, etc., were planted along the edge of the avenue, and preparations were made to set out groups of flowering trees such as *Lagerstroemia* and *Triplaris surinamensis* in the Park Lands to the south of the avenue.

25. At the request of His Excellency the Governor the majority of the trees in the avenue were labelled, strips of zinc sheeting being employed, painted black, with the name in white.

Climbing Plants.

26. Plants of *Bougainvillea* spp. and other climbers were set out to climb on the Saman trees bordering the north side line, but made rather poor growth, it not being possible to give them sufficient attention.

Draft Animals.

27. The Buffalo paddock was reduced in size, as the two older animals were disposed of at the beginning of the year and only the youngest kept. To replace these, two draft oxen were obtained, and a new paddock was fenced for these, behind the rubbish heap, near the south side line.

Miscellaneous.

28. The irrigation pond by the cow pen was cleaned. A pit was dug near the cow pen for the rotting of leaf manure.

NURSERIES.

Ornamental Section.

29. *Glass House*.—The major event in this section was the rebuilding of the Glass House by the Public Works Department. The old house, which was in a very dilapidated condition and beyond repair was pulled down and replaced by a new building, in which were incorporated concrete supports and concrete benches for the plants. These are a great improvement since the old wooden benches were always rotting as a result of continual watering. The space between the benches has been slightly broadened and the level of the floor uniformly raised.

30. *Palm House*.—Steps were taken to increase the shade over parts of the palm house by planting *Thunbergia grandiflora* to climb up the pillars and spread over the roof.

31. *Orchids*.—The orchid collection, which received one or two additions by exchange, including two or three species of *Dendrobium* and *Rhynchostylis retusa*, received attention during the year. A number of plants were hung outside, under the trees, and others were placed on the trees in the nursery to encourage flowering. Some plants previously basketed were tried on wallaba blocks. Four calabash trees were planted in the nursery, on which orchids will be placed as the trees grow big enough.

32. The following orchids flowered during the year:—*Aerides crispum*, *A. odoratum*, *Aspasia epidendroides*, *A. principissa*, *Bifrenaria aurantiaca*, *Bletia Paetula*, *B. purpurea*, *Bollea coelestis*, *Brassia Lawrenceana*, *Broughtonia sanguinea*, *Catasetum scurra*, *C. tridentatum*, *C. viridiflorum*, *Cattleya Bowringiana*, *C. Deckerii*, *C. Jenmanii*, *C. labiata*, *C. labiata var Mossiae*, *C. Luddemania Lowii*, *C. Luddemania Regina*, *C. Rex*, *C. Schroderiana*, *C. Skinneri*, *C. speciosissima*, *C. trianae*, *C. Warocqueana*, *Coelogyne pandurata*, *Cymbidium pendulum*, *Dendrobium aggregatum majus*, *D. chrysotoxum*, *D. Gibsoni*, *D. lituiflorum*, *D. moschatum*, *D. phalaenopsis*, *D. superbum*, *D. transparens*, *Diacrium bicornutum*, *Epidendrum ciliare*, *E. difforme*, *E. osmanthum*, *E. stenopetalum*, *E. variegatum*, *Ezylobium* sp. *Gongora atropurpurea*, *G. maculata*, *Hexisia bidentata*, *Lycaste Powellii*, *Maxillaria* sp., *Mormodes atropurpureum*, *Oncidium altissimum*, *O. confusum*, *O. lanceanum*, *Phalaenopsis amabilis*, *P. Esmeralda Regnerii*, *P. Stuartiana*, *Renanthera coccinea*, *Schomburgkia Lyonsii*, *S. sp.*, *Sobralia panamensis*, *S. sessile*, *Stanhopea bucephalis*, *S. Wardii*, *Trigonidium seemanii*.

33. *Roses, etc.*—There was a very fine display of roses in April. Later in the year the usual ringings of roses, Hibiscus and other shrubs were made to fulfil orders. Some new varieties of roses were obtained by exchange and added to our collection.

34. *Introductions*.—Suckers of several new varieties of Cannas were brought from Jamaica by the Director, and also three plants of Ipomoea sq. Some cuttings of new varieties of Bougainvillea from the same source unfortunately failed to spring. A number of plants, new to the Gardens, were obtained from Trinidad, some of which have already been mentioned.

35. *Solar Propagator*.—This was used during the year for growing cuttings of ornamental plants, and of lime. The following table indicates the average period necessary to obtain sufficient root formation for transplanting:—

<i>Bougainvillea glabra</i>	...	...	50 days.
<i>B. spectabilis</i> var <i>lateritia</i>	...	...	60 "
<i>Bignonia alliacea</i>	...	...	60 "
<i>Cupressus</i> sp....	...	...	40 "
<i>Hibiscus</i> vars.	...	...	36 "
<i>Ixora</i> spp. ...	...	...	45-50 days.
<i>Lagerstroemia flos-reginae</i> -vars	...	...	40 days.
<i>Lonicera japonica</i>	...	...	66 "
Lime ...	...	...	22 "

An attempt to propagate mangoes in this manner failed.

Economic Section.

36. *Citrus*.—The production of budded citrus was continued during the year, and the number of plants raised at the Gardens, together with a further quantity raised at Hosororo, North West District, and sent to Georgetown, proved sufficient to fulfil all orders to the end of the year.

37. All plants raised in No. 1 section of the nursery had been lifted by the end of the year, and these beds were then sown with a cover of beugal beans. Part of No 2 section was planted with sour orange seedling stocks at the beginning of the year, and the remainder, after having been under bengal beans for some months, was planted at the end of the year.

38. During the year 3,355 stocks were budded, and 3,634 plants lifted and basketed—a number of these representing stocks budded in the previous year. In addition 953 basketed orange plants were received from Hosororo. The budwood of standard varieties was obtained from the Department of Agriculture in Trinidad, to whom we are much indebted for the good quality of the bud sticks received. In addition, a quantity of budwood was selected from good local seedlings, a particular from trees at Pln. Haags Bosche on the East Bank. The average of success in budding during the year was 61 per cent.—an improvement on the previous year. A reduction in price was made during the year for plants purchased in bulk.

39. The following table shows the distribution of budded orange and grapefruit plants during the year. (See also Table II., page 121):—

	East Coast.	West Coast.	East Bank.	West Bank.	Demerara River.	Berbice.	Essequibo.	Georgetown.	Rupunini.	Total.
Budded Oranges ...	147	127	665	330	229	216	118	26	14	1,872
Budded Grapefruit	89	3	211	271	127	427	12	8	10	1,158
Total ...	236	130	876	601	356	643	130	34	24	3,030

40. In addition there were 50 budded grapefruit and 496 budded orange on hand at the end of the year which had not yet been taken by those who had ordered them. The total output for the year for Georgetown and Hosororo as distributed from the Botanic Gardens was therefore over 3,500 plants, in addition to which some 800 plants, grown at Hosororo were distributed in the North West District.

41. *Mangoes*.—Approach grafting was carried out as usual, and some 80 grafted plants taken off, of which 56 were distributed by the end of the year, 28 of these being Julies. The mango trees in the nursery, however, are getting old, and it is difficult to obtain a large number of grafts. In a few years time though the trees planted at the Experiment Station will be sufficiently mature to supply the plants needed.

42. The mangoes in the nursery were given a complete dressing of manure, and the drains were deepened during the dry season. The bonavist cover crop which had been established last year was forked in, and sprang again from self sown seed. After several failures, *Dolichos hosei* was successfully established on one of the mango beds.

Attempts at top working mangoes again met with very little success, although crown grafting was tried as an alternative to patch budding.

43. Some seeds of the Chinese Mango, Cambodiana, were received from Puerto Rico, and a few germinated, but the seedlings died back shortly after. Four plants of the "Peach" Mango were received from St. Lucia and planted. A Bombay Mango plant—van Pairi, was received at the Experiment Station from Jamaica.

44. *Introductions*.—Two West Indian Hybrid Limes and one smooth-skinned lime from St. Lucia were planted in the nursery. One "Fuerte" pear and one "Nimlioh" pear from St. Lucia were sent to the Experiment Station, and one "Nimlioh" and two "Galvana" pears from the same source were sent to Hosororo.

45. Six clumps of citronella grass raised from seed received in the previous year were planted in the border behind the D'Urban Park Grandstand, and grew very well there.

46. Roots of five different pasture grasses were received from South Africa early in the year. Only two types survived the journey, one of which, sent as "Warmbaths Grass," proved to be identical with the local introduced Para Grass—*Panicum barbinode*. The other, *Panicum repens*, has been established in beds in the nursery and at the Experiment Station, and will be tried in the savannahs as more material becomes available.

47. A sucker of the Giant Cavendish Banana (Martinique variety) and two suckers of the new hybrid I.C. 2 from the Imperial College in Trinidad were established in the nursery.

48. Plants of the Dwarf variety of papaw (var. solo) raised from seed received from Panama in the previous year were planted in the Vegetable Garden, and seed and seedlings were distributed to a number of people.

49. Rhizomes of ginger were received from Dominica, some of which were planted in the nursery and the remainder sent to the Agricultural Superintendents.

50. *Oil Palms*.—A quantity of oil palm seedlings were raised from seed received from Java in the previous year. A number of these were planted in an area cleared for the purpose at Macaw, East Bank, Berbice River, and others were sent to the Bauxite Company at McKenzie to be planted there. The remainder were distributed to the general public.

51. *Grafting*.—The grafting of avocado pear shoots on to young seedling stocks which had been begun in the previous year was continued, and a greater measure of success attained. Liberian coffee seedlings were raised during the year to repeat the experiments with wedge grafting begun previously.

52. *Miscellaneous*.—Three grape vine plants were set out to climb over an arbour built near the apprentices' room. Several hundred cacao plants were raised during the year to supply orders received from farmers in North West District, Essequibo, and on the East Coast, Demerara. The creepers over the economic section of the nursery were thinned out and the paths in this section given a further covering of burnt earth. A "pear shaped" guava tree in the nursery was blown down and one of the *Manihot Glaziovii* trees was lost similarly.

53. A robbery at the store which resulted in the loss of a number of implements and tools emphasized the dilapidated condition of this building, which was easily broken into.

54. At the British Guiana Workers' League Exhibition held in the Promenade Gardens in September, a display of nursery plants and a demonstration of methods of vegetative propagation were again set out.

— 10 —

Plants put out in the Gardens	{ On parapets	...	...	...	...
	{ Shrubs, trees, etc.	...	...	...	...
Plants basketed and potted	{ Ornamental	...	...	...	...
	{ Economic (except citrus)	...	...	...	...
Plants, ringed, layered, and grafted	...	...	...	...	...
Seed sown	...	{ Ornamental (other than packets)	...	...	...
	...	{ Economic (other than citrus)	...	...	...
Citrus	--	{ Seed sown	...	...	...
		{ Seedlings bedded out	...	...	...
		{ Seedlings budded	...	...	...
		{ Plants basketed	...	...	...

TABLE II.
PLANTS SOLD AND DISTRIBUTED.

Economic Section.				Ornamental Section.			
Budded Grapefruit—				Palms			455
Duncan	...	...	231	Ferns	...	...	183
Foster	...	...	232	Begonias	...	...	36
Marsh	...	...	673	Hibiscus	...	...	20
Walters	...	...	22	Crotons	...	...	21
Orange—				Miscellaneous plants	...	...	402
Jaffa	...	...	182				
King	...	...	5	Total	...	...	1,199
Haags Bosche (local)	...	...	302				
Homassasa	...	...	129	Bamboo (bundles)	...	...	161
T. H. Late	...	...	41				
Majorca	...	...	161				
Naval	...	...	32				
Parson Brown	...	...	366				
Pomeroon (local)	...	...	304				
Ruby	...	...	151				
St. Michael	...	...	77				
Tangerine	...	...	2				
Valencia	...	...	120				
Grafted Mangoes	...	...	45				
Grafted Pears	...	...	7				
Cacao seedlings	...	...	1,671				
Coffee	...	...	90				
Nutmeg	...	...	41				
Other economics	...	...	884				
			5,768				

TABLE III.
STATEMENT OF REVENUE RECEIVED FOR 1988.

Months.	Sale of plants.	Hire of plants.	Sale of pots.	Sale of bamboo.	Sale of lilies.	Miscellaneous delivery, cuttings, etc.	Total.
January	\$ 45 61	\$ 5 64	...	\$ 3 99	\$ 3 00	...	\$ 58 24
February	55 09	...	\$ 9 78	1 70	72	\$ 64	67 98
March	46 85	...	2 08	1 08	70	1 96	52 67
April	61 36	64	1 90	2 29	2 00	36	68 55
May	58 30	...	...	1 43	6 09	09	65 91
June	144 50	1 48	...	77	1 86	24	148 83
July	44 16	72	...	1 28	2 01	72	48 39
August	66 28	...	1 20	1 94	1 03	66	71 11
September	9 97	...	...	76	1 32	08	12 13
October	50 33	1 66	...	94	1 83	...	54 76
November	53 58	...	40	1 88	88	...	56 74
December	135 30	...	48	2 36	48	...	138 62
Total	\$ 771 33	\$ 10 14	\$ 15 84	\$ 20 42	\$ 21 92	\$ 4 75	\$ 844 40

CARNEGIE TRADE CENTRE FOR WOMEN.

56. After this building had been completed, recommendations were made and advice given as to the layout of a garden in the surrounding grounds. A start was made with the planting of a Hibiscus hedge, a few trees and palms, and a number of shrubs round the building. Plants were supplied by the Gardens and also some assistance with labour, and all the subsequent work was supervised by the Horticultural Assistant. The low level of this piece of land and the consequent difficulty of drainage proved somewhat of a handicap to the progress of the garden.

GOVERNMENT HOUSE AND PUBLIC BUILDINGS.

57. The Gardens at Government House were maintained in order, and several new annuals and perennials were established from seed obtained from England. Four budded citrus plants were planted in suitable positions.

58. The Graptophyllum plants were removed from the circular bed and replaced by Hibiscus, and the climbing plants over the northern entrance were thinned out considerably.

59. The beds and lawns at the Public Buildings and Law Courts were maintained in order.

E. B. MARTYN,
Superintendent, Botanic Gardens.

January 12, 1934.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE ENTOMOLOGICAL DIVISION FOR THE YEAR 1933.

CONTENTS.

GENERAL	...	...	...	PAGE.
				125
PRINCIPAL CROP PESTS	...	...	...	125
Sugar Cane ; Rice and Padi ; Pineapples ; Coconuts.				
MISCELLANEOUS PESTS	...	...	...	128
PUBLICATIONS	...	...	...	128

REPORT OF THE ENTOMOLOGICAL DIVISION FOR THE YEAR 1933.

STAFF.

F. A. Squire —Entomologist.
C. Williams —Entomological Assistant.
B. J. Ramotar—Laboratory Assistant.

GENERAL.

Routine inspection and fumigation of seeds and plants imported into the colony was carried out by the division during the year.

2. Considerable additions were made to the collection. Four consignments of insects were despatched to the British Museum including representatives of 18 general and 17 species not previously recorded from this colony by the Division.

PRINCIPAL CROP PESTS.

Sugar Cane.

3. The Dynastids known locally as "Hardbacks" or "Cockles" continued to do considerable damage on the sugar estates although no severe outbreaks occurred. The large hardback, *Dyscinetus geminatus* F. only attacks sugar-cane in the larval stage. The larvae burrow into the "sets" or "tops" or feed on the young shoots. The control practised on the estates is flooding which in normal circumstances under local conditions is easily accomplished. The larvae are very sensitive to excess of moisture and when the land is submerged generally come to the surface where they succumb in large numbers. This species has been very scarce during the year—a fact which is probably attributable to the abnormally heavy rainfall throughout the year, especially the heavy rains during the dry season February—April during which months there is a peak in the larvae stage. Thus for instance heavy rains on March 20 and 21 caused a high mortality among this insect and on March 22 innumerable dead larvae were to be seen in the environs of Georgetown.

4. Outbreaks of the smaller hardback, *Dyscinetus bidentatus* Burm. occurred on different estates during the year. In May some fields at Pln. Port Mourant, Berbice, were badly attacked and had to be abandoned. In the case of this species it is the adult alone that does the damage—the larva confining itself to passing pellets of soil through its intestines. Unlike the larger hardback this one goes not for the "top" but for the shoot immediately below the ground in which it buries itself. In doing so the outer leaf sheaths are perforated but nevertheless maintain a good connection with the roots. The inner leaf sheaths being of smaller diameter are completely severed and so disconnected from the food supply. Consequently these inner leaves are the first to wilt and die giving rise to the "dead heart" symptom. Flooding the land is of little avail against this species and light trapping is unsuccessful. The estates resort to hand-picking which is not very successful, and many a field is decimated and has to be abandoned.

5. The Fungus, *Metarrhizium anisopliae* attacks all stages of both species but its spread is very severely limited by climatic conditions and field observations clearly shew it flourishes most when natural conditions are most unfavourable to the hardbacks. During severe outbreaks the fungus is not to be seen.

6. The Wasp, *Tiphia parallela* Sm. and the Ascidid *Mallophora calidus* F. attack hardbacks but no controlling effect can be claimed for them since the subterranean habits of the latter make it inaccessible. So well do they dig themselves in that even that fierce hunter—*Solenopsis*—cannot reach them unless the soil be

disturbed. Birds have been observed gorging themselves with hardbacks when swarming takes place. But here again the controlling effect is practically nil because it must be remembered that, at the time of the swarming, insects are already played out and as is well known vast numbers die anyway. Swarming with this insect is not marital, as with ants and termites, as mating takes place in the soil long before swarming. These facts are worth mentioning because the craze for biological control already has a hold on the planting community in this colony and might become the worst pest of all. Insects which lend themselves to biological control are few and far between and are generally those in which the more vulnerable stages are exposed for a long time. In the case of the hardbacks all the stages are from 6 inches to 3 feet down in the soil—and a heavy clay at that.

7. General attempts to control these insects and other Dynastids should begin with an investigation of their breeding places. So far very little is known about these areas except that the insects abound in soils rich in organic matter and where the moisture content is suitable. Thus they are commonly found breeding round the edges of ponds where the soil contains a certain amount of humus. The insect strikes the right moisture conditions by digging down or rising to the surface.

8. The yellow aphid of sugar cane *Sipha flava* Forbes has been responsible for a good deal of loss during the year. Severe outbreaks occurred on first ratoons at Plantations Albion, Berbice, and DeKinderen, West Bank, Demerara. Outbreaks occur only during the rainy seasons. With the cessation of the rains and the return of sunny conditions the attack is generally dissipated. Sunlight appears to play an important part in keeping the cane plant free from aphids. Plants kept in the laboratory out of direct sunlight become spontaneously infested with aphids after several days and become clean again if put out in the sun for a few days. The aphids tend to cluster round parts of the leaf slightly yellow and deficient in chlorophyll which shews that they prefer plants weak in chlorophyll.

9. No host plant other than sugar cane has been found, neither have the sexual forms yet turned up and it seems as if the complicated seasonal life history of the aphid in temperate climes is reduced to a simple perennial parthenogenetic cycle without sexuales, overwintering eggs or stem-mothers. Both winged and apterous parthenogenetic females are found, the latter generally arising on crowded leaves.

10. Experiments with various sprays were carried out on different estates. Nicotine sulphate was found both inexpensive and effective. Molasses makes a good sticker and is readily obtainable on the estates. Soap must be added in small quantities to enable the spray to penetrate the waxy scale on the aphid and a minute quantity of copper sulphate is necessary to prevent blackening of the leaves due to mildew. The following formula was finally arrived at after some experimenting:—

Nicotine sulphate (Black Leaf 40)	...	1	pint.
Molasses	...	100	gallons.
Water	...	100	gallons.
Soap	...	2½	lbs.

Spraying for this insect is not always a practicable proposition especially when the attack is diffuse and on well grown plants which cannot be effectively syrayed. In many cases, however, the attack is acute and patchy and affects young plants of only a few months growth. In such cases spraying has proved very helpful and young fields have been saved if not from destruction at least from considerable damage.

11. The practice of stripping the plants of aphid infested leaves, so much in vogue on the estates, is to be deprecated as it only weakens the plant further and does not limit the insect population. Furthermore, stripping takes time and labour and the debris which is usually deposited in the drains only causes blockage and further expenditure. It were far better for the estates to spend this money in purchasing up-to-date spraying machinery and insecticides which are sadly lacking on

most estates. Here, as with "Hardbacks," biological control is the Entomologists bugbear. In the past, so much undue stress has been laid on ladybirds and syrphids and other predaceous enemies of the aphids that on some estates they talk and dream ladybirds.

12. On one occasion labourers were observed on an estate transferring masses of ladybirds from one field to another as if the insects had no wings to fly with. It is true that ladybirds feed on aphids but conditions which most favour the latter least favour the former and the very occurrence of acute outbreaks is in itself partly an indication that conditions do not suit the ladybirds.

13. There were several outbreaks of looping caterpillars (*Laphygma* sp.) in different parts of the colony during the year, which did considerable damage in young cane fields as well as on pastures. Arsenicals sprays and dusts were recommended or, alternately, Sodium fluor silicate.

Rice and Padi.

14. Investigations were carried out on the Rice Weevil, *Calandra oryzae* L., the Padi Moth, *Sitotroga cerealella* Ol., and *Tribolium castaneum* Hbst., all three of which are important pests in this colony. This investigation was held up owing to lack of funds but it is hoped that the new year will see it through to completion.

There were no serious outbreaks during the year of either of the stem borers *Scirpophaya albinella* Gnam. or *Diatraea Saccharalis* F.

Pineapples.

15. The Lycaenid butterfly, *Tmolus echnion* Butl. turned up at the pineapple cultivation of the British Guiana Fruit and Canning Company at Dalgin, Demerara River. The larva on hatching is pink and slug-like and feeds on the corolla just at the time when it is being extruded through the sepals, and burrows its way into the receptacle and from there into the flesh of the young fruit. The attack takes place just before flowering and the first symptom of attack is profuse gumming at the entrance. The insect is still very scarce at the cultivation and only a half-a-dozen attacked fruits have so far been found.

16. The Pineapple bug, *Athaumastus laetus* Mayr., which is very common on pineapples on the coastlands has, strangely enough, not yet reached the cultivation at Dalgin. The eggs of this pest are laid on the fruit or plant in irregular clusters and the entire life cycle is passed on the plant the insect attacking the fruit at all stages of ripeness.

17. The most serious disease that affects pineapples is browning. It is possible to distinguish four types of this disorder. Two of these are probably the outcome of mechanical injury due to insect and birds, but it is to be feared that in all of them the high prevailing humidity is the aggravating factor.

Coconuts.

18. The coconut caterpillar, *Brassolis sophorae* L., Nymphalidae, continues to be the principal pest of coconuts. There is a fairly well marked periodicity and extreme fluctuation in numbers. Sometimes for a few months during the dry seasons it is hardly to be seen but otherwise evidences of mild attacks are nearly always present. Once in five or six years severe outbreaks occur. The insect is remarkable for its gregarious habits. Feeding takes place mostly at night and severe defoliation with loss of crop and death of the tree frequently results.

19. The eggs are laid in rafts on the leaves and takes three weeks to hatch. This long egg period is sometimes the insect's undoing and the egg-parasite, *Telenomus nigrocoxalis* Ash. is very active. There is another hymenopterous parasite *Anastatus redurii* How. which is, however, comparatively rare.

20. The pupae parasites *Spilochalcis brassiolis* Schr. and *Chalcis annulata* F. are at times very numerous. The larvae feed by night, and by day lie dormant in their nests which are generally constructed by spinning 20 or 30 leaflets together. The best control measure is to cut down these nests and destroy the contents.

21. Cockles *Strategus aloeus* Fabr. This beetle attacks young coconut trees (up to three or four years of age) entering the soil at the base of the palm and boring into the stem from below. If left undisturbed they may eventually kill the tree. The control generally practised is to hold routine inspections of the young trees. The presence of the beetle can easily be detected by its burrow near the base of the tree. The insect is then dug out. A quicker method and one less likely to damage the roots is to insert a pebble of calcium carbide in the burrow. This drives out the beetle which can then be destroyed.

MISCELLANEOUS PESTS.

22. Coushi ants, *Atta octospina* Reich, *Atta cephalotes* L., *Atta ferrens* Say., *Atta laevigata* Smith all occur locally. On the heavy soils of the coastal belt they can be partially controlled in localised areas by means of fumigants such as carbon bisulphide. On the sandy soils that occur further inland, however, this control measure is of little avail the soil being too loose to hold gases. Moreover, the colonies there are far more diffuse than those on the heavy clay of the coastal belt. In many cases entire hills are undermined by these insects and owing to the looseness of the soil they are able to excavate new galleries and shafts in a short space of time which they do if disturbed so that the colonies instead of being semi-permanent, as on the coastal belt, are forever shifting over a large area.

23. The principal pests of ornamental plants are various species of the *Coccidae* which generally over run plants following prolonged cultural neglect.

PUBLICATIONS.

24. The following publications were made during the year :—

pp. 78—81 Bull. of the Imp. Inst., Vol. XXXI., No. 1, 1933.

Pt. IV. of Rice Bulletin No. 1, Dept. Agric., B.G.

Press Notes :

The Cane Aphis.

The "Looper" Caterpillar.

The Coconut Caterpillar.

F. A. SQUIRE,

Supernumerary Entomologist.

February 14, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE VETERINARY DIVISION FOR THE YEAR 1933.

CONTENTS.

	PAGE.
GENERAL ...	131
CATTLE ...	131
General ; Conditions under which cattle are kept ; Improvement of Breed ; Milk Supply ; Beef Supply ; Export Markets ; Agistment Areas ; Cattle Tax.	
SAVANNAH COUNTRY ...	134
Cattle Trail ; Field Trial.	
SWINE ...	134
POULTRY ...	135
LIVESTOCK VALUES ...	135
ANIMAL HEALTH ...	135
Anthrax ; Mal de Caderas ; Tuberculosis ; Kidney Worm ; Regulations.	
STOCK FARM ...	136
Cattle ; Pigs ; Poultry.	
FODDER PLANTS AND GRASSES ...	136
MISCELLANEOUS ...	137
Revenue.	

REPORT OF THE VETERINARY DIVISION FOR THE YEAR 1933.

STAFF.

Major T. Bone, O.B.E., M.R.C.V.S.—Government Veterinary Surgeon.
W. Khan —Foreman.

GENERAL.

There has been over-production of inferior livestock throughout the Colony. At the present time all branches of livestock farming are unprofitable, with the possible exception of dairying on a small scale in the Georgetown area where the dairyman has a retail round in the City.

CATTLE.

General.

2. There has been a large increase in the number of cattle in the coast districts, but there has been no general improvement of breed nor of conditions under which the animals live. Old and new cattle-owners persist in keeping their animals under the old system of management with all its attendant risks of over-stocking the limited pastures and semi-starvation in times of seasonal drought and floods. Generally, the farmers are not interested in the establishment of a livestock industry. Most farmers, and others who live in country districts, own one or two cows to provide a milk supply for their households; beyond this point they are not interested in cattle. The larger cattle-owners are interested only in the sale of milk. These owners show a definite preference for cows which require no care, which can live on unimproved savannah without supplementary feeding, and are content with small milk yields. There is an increasing number of irresponsible owners who own neither stable nor land nor agist their cattle, and, except for one or two small ranchers, the supply of beef and work animals is merely an unavoidable side-line to the sale of milk.

Conditions under which Cattle are Kept.

3. Cattle are kept under four different conditions, each one of which has produced a type of animal more or less suited to its peculiar environment. On certain parts of the coast-land the animals, when grazing, are girth-deep in mud and water and rest on dams or sand reefs at night. They exist on water plants and grasses. In other areas the cattle live on comparatively dry land and graze on the short grass. In the creek country the animals live on wet pasture with long grass. The intermediate and interior savannahs are dry land, the pasture of the interior being the better.

4. Coast cattle reared under conditions of mud and water fare badly if moved to the short grass areas of the coast, but do well if moved to the creek lands or the savannahs. Creek cattle suffer severely if moved to the heavy mud and water areas. Cattle of the interior do fairly well on creek savannahs during favourable seasons, but lose condition when placed on heavy coast lands.

5. In all areas where the grazing is limited the animals suffer severely during seasonal floods and droughts because of over-stocking. A more intensive system of management with improvement of breed has been advocated for several years, but finds no favour with most cattle-owners. All the well-drained land on the coast is required for agriculture, and it is useless to attempt improvement of pasture without drainage, so the only practical improvement of conditions for coast cattle in intensely cultivated areas is limitation of number. A reduction of fifty-five per cent. together with a compulsory supply of cut grass obtained from the back lands in times of drought and flood would be a great improvement on present conditions.

Improvement of Breed.

6. Cattle of improved breeds will not give satisfactory results if kept under ordinary coast conditions even if the grazing areas are not overstocked, but what may now be claimed as native cattle can be improved by selection. So far as milk cattle are concerned, the time has arrived when it may be stated that the improvement attempted on a small scale with Holstein-Friesian bulls by Government warrants extension. The average yield of milk of Holstein-Creole heifers is 18 pints; the average yield of a Creole heifer is only 9 pints. Most of the Holstein-Creole heifers are in the Georgetown area and are kept under intensive conditions. The concentrates commonly fed are mainly local products. Guernsey bulls have been imported by Government but only recently.

7. It is suggested that the improvement of the milk breed should be confined to those areas where the land is intensely cultivated, and where owners are willing to keep their cattle under more or less intensive conditions. In less crowded districts, where there are grazing areas of a better kind than the mud and water or short grass areas, an animal of dual purpose breed, such as the South Devon or Red Poll, will probably be suitable. It will be possible to keep these animals on the pastures if they are not over-stocked and cut grass or grown fodder is fed in times of drought and flood. The yield of milk will be sufficient for the supply of the local villages.

8. The creek lands, the Corentyne and Essequibo districts are far distant from milk markets and are suitable for raising beef and work cattle, which are required locally and for export markets. At the present time, any cattle which do not produce milk and are not suitable for work constitute the beef supply. The local markets have a more than ample supply of milk and are glutted with inferior beef animals. There is a need for a better type of beef animal for both the local and export markets. Small trials made with the Hereford breed have given satisfactory results, and this breed is to be recommended for improvement of the cattle in the beef districts.

9. It has been suggested that a Zebu breed should be imported for the purpose of improvement. All coast cattle are a mixture of several European and Zebu breeds. They are hardy animals of exceptionally strong constitution and are good breeders. Zebu blood is dominant in the smaller and European blood in the larger animals. The larger animals are excellent foundation stock. It is many years since any beef cattle were imported and the two types of coast cattle appear to breed their kind. Instead of using a Zebu breed, it may be advisable in any scheme of improvement to include a herd of selected coast cattle for the purpose of crossing with breeds of graded European cattle if at any time there are signs of deterioration and lack of constitution.

Milk Supply.

10. The supply is more than ample, but its cleanliness leaves much to be desired. Dairy stables in the City are closely supervised and have the advantage of a pure water supply, but the great disadvantage of being too near human habitation. They are, however, the source of the cleanest supply. The supply from the villages on the outskirts of the city has all the disadvantages of being too near human habitation and lacks a pure water supply. The cleanliness of this supply depends entirely on the habits of the cow-keeper. The supply from the country districts cannot be supervised at the source. The milch cows are grazed on savannahs which cannot support deep-milking animals. To obtain a quantity of milk the number of cows is multiplied but the labour is not increased.

11. It is unnecessary to go into details—the result is unclean milk sent to the City in dirty containers. Milk produced without any regard to cleanliness cannot be efficiently pasteurised. The only safe-guard under these conditions is sterilisation. Pasteurisation or sterilisation will increase the price of milk. The best policy is to pay an increased price for cleanliness at the source of production. In this Colony,

with its peculiar conditions of grazing, clean milk cannot be produced except under intensive conditions of cattle-management. The best solution for a clean milk supply is the establishment of large dairies, private or communal, which can be supervised.

Beef Supply.

12. The present price paid for slaughter animals is low, but is reasonable for the quality of beef. A larger supply of better beef animals is required locally, but cannot be procured. So long as beef is a side-line in the production of milk, under our present conditions, this demand cannot be met.

Export Markets.

13. There is no market for milk or milk products. In a sense, there is no demand for beef, but the Colony can compete on favourable terms in the supply of fresh beef to the Islands. Our possible markets are now fully supplied by countries outside the Empire, which have no better natural resources, if as good, for the raising of beef cattle. Attempts made to secure a footing in these markets have not been wholly successful but have demonstrated methods by which an export trade can be established.

14. The country now supplying these markets has the advantage in that it has improved its breed of cattle by importation. Our exporters despatched savannah animals and these cattle were graded by the export market as equal to their usual supply. The prices realised were low and unprofitable for the exporters. There was no "ring" to force down the prices; the prices were low because our export was in excess of market requirements. Prices were showing slight improvement when the export of savannah cattle ceased pending negotiations as regards preference and quota. Exporters of coast cattle then tested the market with their stock, but concentrated their sales in the country districts dealing direct with local butchers in those districts. These exporters are apparently satisfied with their prices in that they continue to export when transport is available. But the main or central market is not affected. The exported coast cattle have not been the best of their type. It is generally agreed that our coast cattle are superior to the cattle of the interior—a matter of breeding. The indication is that organised coast-breeders can enter a remunerative market. It will be sound policy to continue export if coast-breeders will improve their stock with the view of competing with better quality and larger numbers. The export markets are willing to accept our animals provided that our breeders will supply animals of good quality.

Agistment Areas.

15. The peculiarities of settlement under which the majority of the cattle-owners are not land-owners, make agistment areas a necessary part of any scheme of livestock development. In milk-producing areas they are required for dry cows and young stock, and in dual purpose cattle areas they are required for all cattle. They cannot, however, take part in the production of purely beef cattle.

16. The system of agistment is open to abuse by both cattle and land-owners. In many instances the responsibility of the land-owner ceases when he provides a boundary fence and collects his agistment fees; and the responsibility of the cattle-owner ceases when he has placed his cattle within the boundary fence and paid the fee. Neither cattle nor land-owner accepts any responsibility for the welfare of the animals. These conditions can be improved. When receiving animals for agistment, the land-owner should accept responsibility for their welfare under normal conditions, which include seasonal floods and droughts. All agistment areas should be divided into paddocks, each one with a permanent water supply, for the purpose of segregating breeding herds, young stock and mature animals. The carrying capacity of the land should be known and the number of animals accepted for agistment should be limited accordingly. A reserve of forage should be cultivated for use during normal floods and droughts. Improved bulls should be provided for the breeding herds. For providing these advantages the land-owner is entitled to adjust his

fees. The cattle-owner should consider whether his animals are worth the agistment fees or not. There are many worthless animals on grazing areas. Sugar estates have grazing areas on which the cattle of their employees are allowed to graze. In most cases these are mud and water areas of which no improvement is practical, but the number of cattle can be reduced.

Cattle Tax.

17. A tax was recommended by His Excellency the Governor, years ago, but the various Committees appointed to consider live-stock measures considered the time inopportune. Irresponsible cattle-ownership is a great handicap to improvement of breed and progress, and such ownership is increasing. A tax in one form or another is necessary. According to law, all cattle have to be branded with a registered brand. An annual fee for registration of brands should be imposed. A scale of fees according to the number of cattle owned and whether animals are kept as a part-time or whole-time vocation could be worked out so as to impose no hardship on cattle-breeders.

SAVANNAH COUNTRY.

18. The intermediate and interior savannahs can be considered as the cattle country of the Colony. Mixed farming on the coast is possible only for the few. The coast lands are agricultural country; and cattle except under intensive conditions, can be kept there economically only until such time as improved drainage makes the land suitable for agriculture.

The intermediate savannahs are extensive and have a good water supply. The pasture is of inferior quality. In recent years good results have been obtained on selected areas, and a resident rancher has demonstrated that the pasture can be improved.

19. The interior savannahs are excellent cattle country capable of supporting cattle of improved breeds without improvement of pasture, provided that the animals and pasture are properly managed. The requirements for settlement are bulls of improved breeds, selected foundation stock, and fencing. These savannahs offer good opportunities for experienced ranchers with capital.

Cattle Trail.

20. Many improvements have been made on the trail from the interior to the intermediate savannahs. The daily drives have been made much shorter, and sound cattle properly driven can now complete the journey in reasonable condition.

Field Trial.

21. A field trial conducted with the present inferior savannah animals satisfactorily demonstrated that shorter daily drives and careful driving reduced the loss of condition and the losses due to exhaustion and escapes into the forest. Selected grazing areas on the intermediate savannahs were prepared for the reception of these animals. The cattle were kept in rest camps for varying periods up to six months with good results. Cattle of improved breed can now reach the coast in good store condition suitable for cattle-farmers of the coast and creeks to finish off as prime beef. The present inferior interior savannah animals, however, are not suitable for feeding yards.

SWINE.

22. The improvement in the quality of pigs is very gradual and somewhat disappointing. The average pig-keeper believes that the only food suitable for pigs is refuse. It may be that the local market prices make it impossible to feed anything except the refuse of rice mills and oil factories. The difference between pigs of the same breed and age fed on this refuse and others fed with a balanced ration is remarkable. There is every indication that the improvement of the breed of pig will cease if at any time the distribution of pigs of the improved breed is stopped. The export market appears promising in that exporters are ready to

despatch pigs whenever transport is available. Improvement in management and feeding would probably increase the demand by export markets, and cause an improvement of local prices.

POULTRY.

23. A wave of enthusiasm for standard-bred birds occurred two years ago. The enthusiasm waned rapidly and abruptly. A bird of any breed, no matter of what quality, is to-day worth its weight in the local market and no more.

24. Poultry enthusiasts and Government have distributed birds and eggs at local table prices in an endeavour to encourage poultry-keeping, but with no results. What is generally desired is the bird which can live and lay on the refuse heaps of rice dust, and find its own shelter. The segregation of pure-bred birds is too much trouble or not considered worth while. Eggs, small and dirty, are collected one week or another—time is of no importance—and are sold to wholesale dealers at 15 cents per dozen. A few poultry-keepers obtain better prices by selling fresh eggs to private customers, but no breeder of standard-bred birds can obtain a reasonable price for a sitting of eggs.

25. In country districts, pure-bred birds allowed free range, but kept away from rice-dust heaps, which are usually "fowl-sick," and provided with shelter against heavy rains will give much better results and at no greater cost.

LIVESTOCK VALUES.

26. Over-production of inferior stock has spoiled all markets. A period of scarcity may cause a temporary increase of prices, but the natural resources for the raising of all kinds of inferior livestock without care or attention are so many that any period of scarcity can be only transient.

27. There can be no improvement of breeds at present prices, and keeping of livestock cannot be remunerative. A market which will discriminate between good and inferior products and pay for quality is required. A demand will create a supply.

ANIMAL HEALTH,

Anthrax.

28. An outbreak of anthrax occurred amongst cattle on a crowded unenclosed area in Berbice. The area was declared infected and placed in quarantine. It was expected that the cattle-owners would realise the danger of the disease and co-operate with the Department by controlling the movements of their animals and having them inoculated. Unfortunately, most of these owners belonged to the increasing group of irresponsible owners who own neither land nor stable nor agist their cattle.

29. Rural constables were employed to guard the area but were unable to control the movement of cattle and their removal by their owners. Inoculation of the animals was strongly opposed on the grounds that the cattle could not be collected. Under great difficulties a few hundred head were inoculated; the remainder were collected by their owners and driven up the coast. Farmers on neighbouring estates took the precaution of inoculating their animals.

30. Fortunately, there has been no serious aftermath. The Colony is remarkably free from contagious and infectious diseases (animals), and it is to be regretted that stock-breeders of the coastlands cannot be protected from risks caused by uncontrollable people who own one or two animals. Livestock regulations, which can be enforced are urgently needed.

Mal de Caderas.

31. Blood-smears from a ranch on the intermediate savannahs showed trypanosomes. Most of the horses on the ranch had died and others were sick. The disease was brought into the Colony by infected horses from the Rio Branco Dis-

trict of Brazil. Horses on a border ranch were infected, and unfortunately were used when driving cattle through the trail. These sick horses were accommodated in small corrals along with horses belonging to ranchers on the intermediate savannahs.

Tuberculosis.

32. Over 6,000 head of cattle were slaughtered in one abattoir and 7 carcasses were condemned on account of tuberculosis. The percentage of carcasses condemned for this disease in our export market was high. This is no reflection on our meat inspectors. In the export market the animals found infected were coast cattle. There is no regulation controlling export of cattle. The animals were clinically inspected at the time of export—tuberculosis cannot be diagnosed always under such conditions. It has happened that animals rejected as unsuitable for export were exported. The exporters gained nothing on these animals.

Kidney Worm.

33. A great number of pigs and parts of pigs are condemned on account of lesions caused by the worm *Stephanurus dentatus*. The prevalence of this parasite can be reduced when powers are granted to control the conditions under which pigs are kept.

34. There are no other serious diseases in the Colony, but there are minor ones which may in time cause heavy losses unless they are kept under control.

Regulations.

35. Our stock regulations have long been obsolete. They were revised some time ago, and await legislative approval. The present system of branding is of no value either from the police or veterinary point of view, and is certainly most damaging to the hides.

STOCK FARM.

36. The size of the farm, not in acres, but in the number of animals and birds demonstrates the lack of interest in livestock.

Cattle.

37. The Department of Agriculture owns six bulls, eight cows, one heifer, and three heifer calves of Holstein-Friesian breed, and two Guernsey bulls. Three Holstein-Friesian bulls are in country districts. During the year the bulls on the farm have been fully employed; more are required. Young Holstein-Creole bulls have been sold at \$80 to \$100 by farmers of the Georgetown area. There is a very strong demand for Holstein-Creole heifers.

Pigs.

38. A boar and two sows of Canadian Berkshire breed were imported. During the year 42 young pigs were sold to pig-keepers.

Poultry.

39. Pens of Rhode Island Reds, White Wyandottes, White Leghorns and Aylesbury ducks have been imported. During the breeding season, the poultry section was unable to supply a large number of eggs due to the poor results obtained last year. Thirty-one cockerels, thirteen hens and three thousand four hundred and fifty eggs were sold. A small hatchery has been started. A large number of day-old chicks imported by private poultry-keepers from the United States of America have been reared in the battery brooders. Hatching of chicks was started in December and will be continued throughout the early months of next year. The prospects of a large increase are good.

FODDER PLANTS AND GRASSES.

40. There are a large number of indigenous plants and grasses on the coast lands which are palatable to stock. On most grazing areas these are trampled out of existence by overstocking. They grow luxuriantly in the backlands, where they

are collected by careful cow-keepers. There is no grass or plant which will grow under overstocked conditions, but partly drained pastures of the coast will improve naturally if the number of animals is limited.

41. The creek lands could be improved if cattle-owners introduced coast grasses and plants. The improvement of the pasture of the intermediate and interior savannahs is a problem which can best be solved by trying out grasses imported from more or less dry countries, and in order to test these grasses it is necessary to establish an experiment station on one or other of these savannahs. Wynne Grass, for instance, has been established on the high land at Wauna and Mabaruma in the North West District where there are no cattle. On the low-lying and heavy land of the coast, small plots have been established with difficulty; yet, it is a grass which may be most useful on the intermediate savannahs.

42. *Panicum repens*, imported from South Africa, makes very slow progress on heavy land, but may do better on the light soil of the interior. Warmbaths' grass, imported from South Africa, proves to be Para grass. Para grass may prove suitable for certain areas of the interior savannahs.

43. The grasses and plants which grow only on well-drained areas of the coast may prove valuable in areas of the intermediate and interior country.

44. *Andropogon nodosus*, a grass found on a well-drained part of the Experiment Station, promises well and should be tried out in the interior.

45. Horse weed, doveweed and *Phaseolus semi-erectus* are all worthy of trial in the interior, but to carry out trials experiment stations are necessary.

46. The use of lime—now obtainable in the Rupununi—on small areas where grass did not grow on the Stock Farm, has helped towards a luxuriant growth of grass.

MISCELLANEOUS.

47. *Revenue*.—Sale of stock, egg, stud and inspection fees gave a revenue of \$990.45.

T. BONE,
Government Veterinary Surgeon.

January 30, 1934.

